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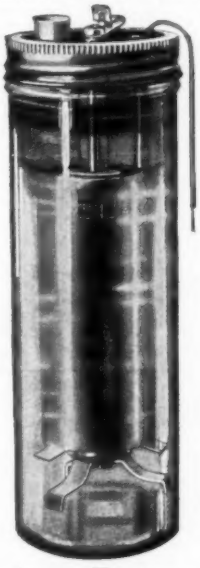

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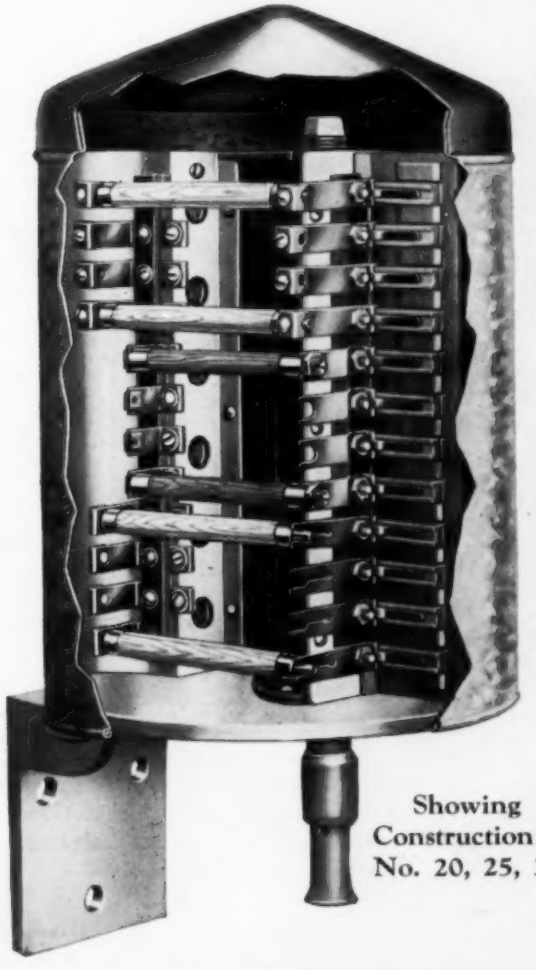

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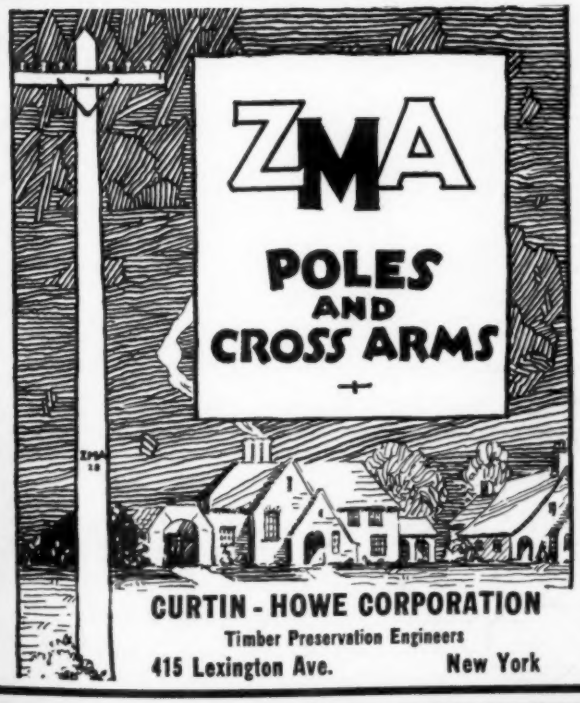

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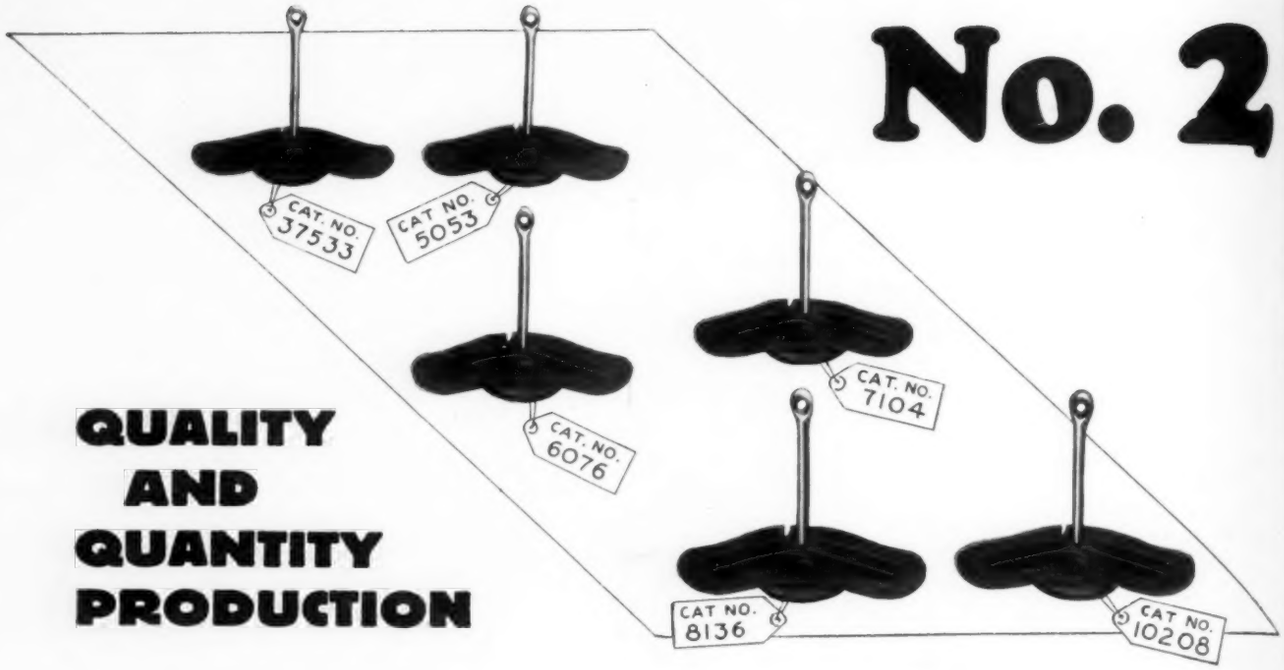

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Telephone Engineer

Volume 34 APRIL, 1930 No. 4

Utilities and Unemployment In a report on unemployment presented to a business men's association in one of the larger cities of the country it was pointed out that the three public utility corporations operating in the city had kept practically a uniform number of people on the pay roll regardless of business conditions. According to news reports the report said among other things: "The nature of the public utility business is such that its payroll can not be made to conform with ordinary fluctuations of business, which is the case in most other industries. Adequate equipment, service and schedules must be maintained regardless of whether revenues are high or low. Consequently, the utilities present a picture of stabilized industry and permanency of employment which are a decided asset to the community. The regular working forces are maintained at a constant volume augmented, of course, by additional labor for construction expansion and replacement work on the outside during the summer months."

The report goes on to show for the past fourteen months the high point of employment in July 1929 was 11,300 for the three utilities and the low point 10,300 in January 1930 a difference of 1000 to account for the peak of the construction season. It shows that two persons out of each one hundred are employed by the public service companies. The report says further: "During periods of industrial uncertainty, the picture of stabilized employment presented by the utility companies in ——— has a reassuring value. It should be remembered that in times of business depression involving a forced reduction of expense, the payroll is the first point of attack. While this avenue of relief is open, of course, to the utility companies, the reduction in operating forces can not be accomplished without impairment of their services to the public. This aspect of the economic situation might well engage the attention of some of those who engage in the profession of attacking the public utilities."

The conditions in the city covered by the report are not different from those the country over as far as public utilities are concerned. Public utilities can never be accused of contributing to general unemployment in times of depression because they can not and do not lay off employees, wholesale, when business gets dull. This is a situation that utility managers might well spend some time discussing with the public in their communities.

Why Not a Uniform System of Reports? At this time of year telephone auditors and managers are just beginning to draw a breath of relief as the last reports of 1929 operations are completed and dispatched to the various regulatory and other bodies having power to require reports. No doubt, each year brings to mind the question as to why reports are so nearly alike and yet so different.

Practically every report that must be made requires a balance sheet and an income statement. In general, the forms of the statements are alike but the grouping of accounts is just different enough to require some recapitulation of the accounts to make them fit into the form. Nearly all of the reports require data on plant measurements, pay roll payments, traffic statistics and other similar matters. Nearly all of the reports are just enough different that the data for one will not quite fit into the pages of another.

It strikes us, for instance, that the matter of classification of employees as to rates of pay is not of sufficient importance to the Interstate Commerce Commission and a state regulatory commission that two separate forms should be used by the two bodies. Other examples might be cited.

We are told that it is probable that revised accounting instructions for the higher class companies will probably be ready so that their use can be commenced by January, 1931. We have had conferences which apparently have done much in evolving a more logical arrangement of accounts and a more easy transition from a lower class to a higher class. After the new system of accounts is placed into effect, why not some conferences between the I. C. C., State Commissions, tax boards and others in

order to draw up a uniform type of report that will meet the requirements of all such bodies.. Simplified practice is the order of the day in business.. Let us have simplified practice in report making.

Replace More Wire

The engineer of a telephone company located in an area which was visited recently by a severe sleet storm told us of an experience with one of the lines in that territory. This particular line, a rural line carrying a number of wires, was overhauled during the past summer and many new poles were placed to replace those weakened by decay. No wire was replaced during this overhauling and much of the wire that was left was badly rusted iron wire.

When the sleet storm came, the rusted wire failed throwing additional load on the poles, and first the old poles and then some of the newer ones snapped off. The line was almost a total wreck. Where the iron wire was comparatively new in the same territory, poles were pulled out of line and in some cases were kicked out of the ground, but few were broken. As he explained it to us, it seemed that if the wire had been replaced at the time the line was overhauled, there is reason to think that the line would have escaped without excessive damage.

This experience brings us again to the comment that we do not understand why so many companies treasure their old iron wire. When a line is being overhauled and new poles are being set to take the place of old ones, it does not add much to the cost of the job to replace the bad wire. As one manager said several years ago, "It's the wire you talk over." Replacement of old rusty wire when lines are being worked over will not only improve transmission but will give added strength to the line when the storm king beards the wires with icicles.

Telephone Directory Improvements

One of the minor improvements in telephone service in recent years has been the improvement in the telephone directory. As the Bell annual report points out, it is no small job to provide accurate and convenient directory information concerning the millions of telephones in the country. Anyone who has had the job of getting out a telephone directory for even a very small company knows the difficulty of getting out an absolutely correct list of subscribers and their telephone numbers.

The growth of the larger exchanges like New York and Chicago makes the problem of supplying adequate directories without too great bulk a real one. Much has been done in the way of adopting sizes of column, type faces, systematic methods of placing names in alphabetic order and page and column heading to make reference easier. Advertising space in the general lists seem to be more and more restricted, the general tendency being to transfer the display advertising to the classified lists.

The classified lists and the advertising displays have been improved so that they have become a really important adjunct to the information furnished by the directory. One of the improvements that has been adopted by a number of companies is the removal of all advertising from the cover. The front cover of any magazine or directory is the most valuable advertising space in the medium and the telephone companies that have adopted the plan of an ad-less front cover are really using the best advertising space for their own purposes.

There is still room for improvement in some of the directories that come to our desk. There are still many directories that are primarily vehicles for advertising space rather than for lists of telephone subscribers. The page of a directory which is given over to advertising on the top, bottom, inside and outside edges leaving space for only an inch or two of names is not a very good advertisement for the telephone company itself.

The remedy for such directories is to place advertising rates on a basis that will sustain the directory without giving over too much space. The value of telephone directory advertising is so well established that it does not have to be sold at bargain rates. There is enough advertising patronage available in almost any town to sustain the directory. There are competent directory advertising firms in the field that can sell this advertising and aid in getting out a presentable directory. There is phone directory production.
no longer any excuse for slipshod methods in tele-

Conditions Improving

Activities among telephone companies throughout the country indicates that there is only a slight decrease in the amount of construction work this spring from that of a year ago. Business conditions probably retarded the work for a month or more, but as the spring months advance a decidedly active season is indicated for the year. Programs begun last year are being pushed to completion, while many companies who failed to get under way last year are now pushing ahead. The steady growth of the industry demands the constructive work continued from year to year and the guiding heads of this large utility will see that it keeps pace with progress.

Straightforward Trunking Studies

The Second of a Series of Articles by E. R. Stonaker* and E. R. Costich** Gives a Narrative of Traffic Operation of System Adopted in Rochester

In making the study of straightforward trunking at Rochester the following equipment was installed.

Three positions of key listening equipment were installed at the main "B" board. This equipment had the following features:

Type "A" Equipment

1. Key listening.
2. Master party-line ringing key set.
3. Busy back key.
4. Pre-select feature provided on both ringing key and busy back key operation, thus giving over-lap possibility in the operation of listening, ringing and busy back keys.
5. Trunks to intercept desk, with "call wire" instruction circuit from "B" to intercept operator.
6. Available trunk and "B" position lamp indication at "A" board.

B—Three positions of standard applique automatic listening equipment were installed at the Main "B" board. This equipment had the following features:

Type "B" Equipment

1. Automatic listening.
2. Party line ringing keys individual to each trunk, with "W" or individual line ringing set, making operation of ringing key necessary only on calls to parties J, M & R.
3. Busy back jacks.
4. Pre-select feature on "W" and individual line ringing provided by means of release key to be operated on such calls, thus providing over-lap possibility. J, M & R ringing either pre or post select.
5. Trunks to intercept desk with "call wire instruction circuit from "B" to intercept operator.
6. Available trunk and "B" position lamp indication at "A" board.

C—Three positions of the automatic listening equipment especially developed during the study were installed at the main "B" board. This equipment had the following features:

Type "C" Equipment

1. Automatic listening.
2. Master party line ringing key set with "W" and individual ringing key normally set.
3. Busy back key.
4. Pre-select feature provided on both ringing key and busy back key operation, thus giving over-lap possibility in the operation of ringing and busy back keys.
5. Trunks to intercept desk with "call wire" instruction circuit from "B" to intercept operator.
6. Available trunk and "B" position lamp indication at "A" board.

D—The trunk groups from Culver and Monroe to Main were terminated on each of these different "B" equipments during different periods.

E—The same "B" operators occupied these positions during these periods.

F—Idle trunk, idle "B" position lamp indicating equipment was provided at both Culver and Monroe "A" boards.

G—Certain changes were made from time to time during the study in equipment developed by the Bell Telephone laboratories, in order to determine what features were of value in the handling of traffic.

H—The same observers were used throughout all periods both in the "A" and the "B" observations.

Thus the same traffic, the same operators and the same observers were involved in the observations made on each type of equipment. The results, therefore, are properly comparable from every viewpoint. It was felt that the decision should be based on the results as shown by the observations made at the "A" board on "B" operator answering time on straightforward trunks, rather than on the load possibilities shown by the various types of equipment at the "B" board.

Narrative of Traffic Operation of Straightforward Trunking Circuit Recommended as Standard for Rochester City

The following is a narrative of the traffic operation of the straightforward trunking circuit which was finally adopted:

1. *Division of Large Trunk Groups.*

Every large trunk group is divided into sub-groups of ten trunks each.

2. *Method of Dividing and Terminating Trunk Groups.*

Each of these sub-groups terminates on a different "B" position, but they all appear on a single large group in the outgoing trunk multiple at the "A" board, unless the whole outgoing trunk multiple at any one office is split one or more times in order to conserve "A" board space. In such case, of course, every large outgoing trunk group will be split accordingly.

3. *Combined Lamp and Designation Strips.*

Combined lamp and designation strips are associated with the whole outgoing trunk multiple.

4. *Significance of Available Trunk Lamp Indication at the "A" Board.*

A lighted lamp over an outgoing trunk jack indicates that that trunk is the next available trunk in that sub-group. It also has further significance with reference to conditions at the terminating end, as explained in later paragraphs of this narrative.

5. *Operation of Sequence Circuit of Lamp Indication at the "A" Board.*

The lamp sequence at the "A" board travels over the full sub-group of ten trunks before seizing the lower numbered trunks of that sub-group, that is, if trunks on jacks No. 1 to No. 6 in a sub-group are busy, the lamp will next light over the seventh jack in the sub-group, even though one or more trunks on the intermediate jacks between No. 1 and No. 6 may have been released in the meantime. The lamp sequence will not drop back to these intermediate released trunks until it has traveled across the full sub-group of ten, when it will start traveling over the sub-group again, lighting the lamp over the lowest numbered available trunk in the sub-group first.

6. *Significance of Available Occupied "B" Position Lamp Indication at the "A" Board.*

This lamp indication at the "A" board is also tied in with the "B" operator's control circuit in the following manner:

(a) Ordinarily no lamp will light on a sub-group while the head set of the operator at the "B" position at which the group terminates is cut across any trunk terminating at that position. Thus, under this condition, the lighted lamp indicates an available trunk and "B" operator, both, and a zero answer will be received when the "A" operator seizes the trunk.

(b) If, however, the head sets of the "B" operators at all the "B" positions, at which sub-groups of a given total inter-office trunk group terminates, are cut across some trunk terminating at their positions, all at the same time, the lamp at the "A" board over the next available trunk in each sub-group will be lighted. Under this condition the lighted lamp, while it will indicate an available trunk, will not indicate an available "B" operator but instead, the "B" operators at all the positions at which trunks in this inter-office trunk group terminate being busy, the "A" operator is given a choice of all the sub-groups from which to select the idle trunk.

*Consulting Traffic Engineer, Rochester Telephone Corp., and Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
**Traffic Engineer, Rochester Telephone Corp., Rochester, N. Y.

(c) While any of the "B" positions at which any sub-group of a total interoffice trunk group are unoccupied, no lamps will be lighted at the "A" board in these sub-groups, unless all of the trunks in the sub-group terminating at the occupied "B" position are busy, when lamps will begin to light in the sub-group terminating at the next adjacent "B" position, etc., provided the splitting and grouping keys at the "B" board have been properly operated.

7. *"A" Operator Selects Outgoing Trunk.*

When receiving a call to an office with this type of straightforward trunk equipment, the "A" operator plugs the calling cord of the pair used into the next available trunk of one of the sub-groups to that office, as indicated by the lighted lamp. If the lighted lamp has indicated merely an available trunk and not an available "B" operator, because of all "B" operators handling that trunk group being busy, the guard lamp at the "B" position, associated with that trunk, lights steadily.

8. *Selected Trunk Seized by "B" Position Sequence.*

When the trunk selected by the "A" operator is seized by the sequence at the "B" position it is immediately cut across the "B" operator's head set and the guard lamp associated with it starts flashing.

Note: If the lighted lamp at the "A" board has also indicated an available "B" operator, the trunk will be cut across the "B" operator's head set immediately it is selected by the "A" operator and will, therefore, come in with a flashing guard signal, instead of a steadily lighted one.

9. *Operation of Sequence Trunk Selection Circuit at the "B" Position.*

The sequence circuit at the "B" position connects the operator's head set to the trunks selected by the "A" operators in a pre-determined sequence regardless of the order in which the trunks germinating at that position are selected, that is, if trunks Nos. 1, 8, 5, 6, 9 and 10 are selected in the order named, the sequence circuit will select the trunks in the following order: 1, 5, 6, 8, 9 and 10.

It is seen, therefore, that the sequence travels across the full forty trunks terminated at a given "B" position from the lowest numbered through to the highest, and then starts over again, seizing such trunks as have been selected by the "A" operators, as it travels across the full position. This sequence over the full forty trunks is preserved at the "B" position regardless of the fact that there are, normally, four sub-groups of ten trunks each terminated at the position, each sub-group usually containing trunks from a different office and which are being selected by a sequence at the "A" board, traveling over the full sub-group of ten, as described in paragraph No. 5.

10. *"Call Passing" or "Order" Tone.*

A "call-passing" or "order" tone is sent out on the circuit as soon as it is connected to the "B" operator's head set. It consists of two short, sharp, high-pitched sounds and is heard simultaneously by the "A" and the "B" operator. Thus it is a notification to the "B" operator that an order is about to be passed to her, while the flashing guard signal indicates on which trunk the order is to be received and at the same time it is a notification to the "A" operator to pass the call, as the "B" operator is waiting to receive it.

11. *Connection of Master Ringing Key Set to Selected Trunk.*

The master ringing key set is connected to the selected trunk at the same time that the trunk is cut across the "B" operator's head set.

12. *Operation of Master Ringing Key Circuit.*

After the "B" operator has received the order from the originating operator, she operates the electrically locking master ringing key corresponding to the party desired. The operation of this key not only sets up the proper code of ringing on the trunk but also releases her head set from that trunk and makes her available for another call.

13. *Operation of Trunk Guard Lamp When Trunk is Selected by "B" Position Sequence.*

The guard lamp of the trunk lights steadily as soon as the ringing code has been selected and the "B" operator's head set released from the trunk.

14. *"B" Operator Inserts Trunk Plug in Called Line Jack.*

If the "B" operator, after making the usual busy test, finds the called line idle she inserts the plug in the jack and machine ringing of the selected code is sent out over the called line.

15. *Operation of Trunk Guard Lamp When Connection Is Made with Called Line.*

The guard lamp of the trunk is extinguished and remains so until the trunk is released by the "A" Operator.

16. *Operation of "A" Board Cord Supervisory Signals.*

The usual supervisory signals are received on the "A" cord circuit indicating ringing interval, answer by called party and disconnection by called party.

17. *Operation of Trunk Guard Lamp Upon Disconnection by the "A" Operator.*

When the "A" operator takes the plug from the outgoing trunk jack, the guard lamp at the "B" board lights and the "B" operator removes the plug of the trunk cord from the called line.

18. *Operation of the Master Busy Back Key Circuit.*

If the "B" operator, on making a busy test, finds the line in use, she drops the trunk cord and operates the master busy back key which places the standard busy back tone on the trunk and extinguishes the guard lamp. She has previously operated the proper ringing key which has disconnected her set from the trunk and allowed another trunk to be connected to her set. Since the "B" position is equipped with common busy test, she is enabled to overlap the testing of the called line on the first trunk and either the connection of that trunk to the called line if it is found idle, or the sending back of the busy signal if it is found busy, with the taking of a new order on the second trunk. This is possible, because the circuit is so arranged that the busy signal cannot be returned until the ringing key, which also acts as a release key, has been operated. Furthermore, the operation of this busy key will send the busy signal back on the trunk that has just been released from her set; not on the one to which her set is connected at the time.

19. *Receipt of Busy Back Signal by Calling Party and Operation of "A" Board Cord Supervisory Signal.*

The busy back signal placed on the trunk is received by the calling party, who is expected to disconnect upon its receipt. The calling cord supervisory signal at the "A" board stays lighted while the busy signal is on the trunk, the same as though the calling line were being rung. The "A" operator receives no busy signal except as she chances to supervise on a call while the busy tone is on the trunk.

20. *Release by "A" Operator of Trunk Having Busy Back Signal Thereon.*

As soon as the "A" operator releases the trunk the busy back signal is taken off the trunk. Thus the possibility of a busy back tone being still on a trunk when re-taken by an "A" operator, as happens where busy back jacks are provided and a re-taken trunk is still connected to a busy back jack at the "B" board, is precluded.

21. *Possibility for Ringing Frequency Selection Either Before or After Connection with Called Line.*

If the "B" operator fails to operate a ringing key before plugging the trunk cord into the multiple jack of the called line, which is the prescribed operating practice with this circuit, she may do so afterward and the proper ringing current will be selected and sent out on the called line, while at the same time her head set is disconnected from the trunk.

22. *Re-Selection at "A" Board of Trunk Previously Released at "A" Board But Not Yet Disconnected at "A" Board.*

Should an "A" Operator re-select a trunk which, although it has been released at the "A" board, has not been disconnected from the "B" board multiple jack, the trunk guard lamp at the "B" board, having already been lighted steadily by the disconnection at the "A" board on the previous call, will remain

steadily lighted. The trunk will enter the "B" position sequence the same as any trunk selected at the "A" board and, when it is connected to the "B" operator's head set, the guard lamp will start flashing and the order tone will be sent out on the trunk in the regular manner, as described in paragraphs No. 8 and No. 10. The operation of any of the master ringing keys, while the trunk is still plugged into the multiple jack of the line previously called, will have no effect upon this trunk, or the line to which it is connected, so long as the "B" operator's head set has not been connected to the trunk. After the trunk has been connected to the "B" operator's head set the operation of the ringing key, while the trunk is still in the multiple jack of the previously called line, will prepare a circuit for the proper code of ringing for the new call, but the ringing will not yet be sent out on the line. The trunk will be disconnected from the "B" operator's head set by the removal of the trunk cord from the multiple jack of the previously called line and when connection is made with the newly called line the ringing current will be sent out over it. If the trunk cord has already been removed from the multiple jack of the previously called line before the ringing key is depressed the proper code of ringing will be set up and the trunk immediately disconnected from the "B" operator's head set, as described in paragraph No. 12.

23. *Trunk Abandoned by "A" Operator After Having Been Selected at "A" Board.*

In case of an "A" operator, having selected a trunk, disconnects before the trunk is connected to the sequence circuit of the "B" position, the lighted guard lamp will be extinguished and the circuit restored to normal. In case the "A" operator disconnects after the trunk has been connected to the sequence and the ringing key has been depressed, but before the ringing has started, the disconnection by the "A" operator will set up certain circuit conditions which will prevent the ringing current being sent out on the called line. If the call is abandoned during ringing, the disconnection by the "A" operator will disconnect the ringing current from the called line. In either of these two latter cases the disconnect signal will be displayed at the "B" position.

24. *Automatic Recall from Intercept Desk.*

When it is necessary for the "B" operator to refer the call to the intercept operator, the ringing key having been operated in the usual way, the trunk plug is then inserted in an outgoing trunk to the intercept desk. The "B" operator is disconnected from the trunk when the ringing code is set. When the intercept operator now wishes to converse with the "B" operator to have her complete the call, she operates a key at the intercept desk, which will cause the trunk to again enter the "B" position sequence and to be automatically connected to the "B" operator's head set in the regular order. The operation of this key by the intercept operator will also light a lamp associated with the intercept trunk at the "B" position, indicating to the "B" operator that the trunk is coming back into her sequence, on a re-call from the intercept operator. She will ordinarily not disconnect the trunk from the intercept trunk, therefore, until after it has been reconnected to her head set and she has received instructions from the intercept operator. In case she does disconnect before receiving instructions from the intercept operator, she will receive them from either the calling party or the "A" operator, whichever one she meets on the trunk. The operation of the trunk guard signal in this condition is the same as on a trunk re-taken by the "A" operator while still connected to a jack in the "B" multiple, as described in paragraph No. 22.

25. *Lockout of "B" Operator After Operation of Ringing Key.*

After the operation of a ringing key and before the insertion of the trunk plug in the multiple jack the "B" operator's head set cannot be re-connected to the trunk except on a re-selection of the trunk at the "A" board. Although it would be possible for the "B" operator in the case of wrong ringing code selection, for instance, to cause the trunk to re-enter the sequence by tripping the ringing through momentary connection with the holding jack, it is felt that such an operating practice would not be satisfactory and it is planned to prescribe in the operating method that in such cases, connection will be made with the Intercept Desk and the call handled as one for an O. K. number. Thus, after the operation of the ringing or busy back key, the "B" operator will be locked out of the trunk except as it might be re-selected at the "A" Board, or on a recall from the Intercept operator.

26. *Emergency Operation in the Event of Tone Failure.*

In order to care for the operation of the equipment in the event of order tone failure, a key has been provided at the "B" position which when operated, will separate the part of the circuit which provides the order tone feature from the rest of the circuit. This will permit the "B" operator to go on operating on an automatic listening basis, challenging verbally as each call is cut across her head set, since the order tone is not being sent out.

27. *Emergency Key Listening Operation.*

In order to provide for the operation of the equipment in the event of failure of the sequence relays, the "B" position has been provided with individual, electrically locking listening keys per trunk, which are brought into operation on a manually operated basis, replacing the automatic listening sequence circuit, by the operation of a key at the "B" position affected, associated with the control circuit. While the "B" position is being operated on this emergency key listening basis, the trunk guard lamp comes in flashing, instead of steady, when a trunk is selected by an "A" operator, keeps flashing while the "B" operator cuts across it by operating the listening key, goes steady when she releases herself from the trunk, after having received the order, by operating the ringing key and is extinguished when the trunk plug is inserted in the multiple jack. Otherwise the operation of the trunk guard lamp and of the Master Ringing and Busy Back keys is the same as when the automatic listening sequence circuit is being used. Thus a very efficient key listening equipment is provided for emergency use, because of the overlap possibilities existing in the operation of listening, ringing and busy back keys, etc.

28. *Splitting and Grouping of "B" Positions.*

Provision is made for splitting the right half of each "B" position and associating it with the position to the right by means of the operation of the splitting key provided at each "B" position. The operation of the grouping key provided at each "B" position will associate the entire position with the one to the left unless the splitting key at the previously mentioned position is also operated, when the left half of the position will be associated with the position to the left and the right half will be associated with the position to the right. All functions of the position and control circuits are associated with the circuits of the occupied position when these keys are properly operated. Thus it is possible by operating the splitting and grouping keys at different points in the switchboard line-up, to extend an operator's division to any number of trunk groups desired. Furthermore, the operation of these keys is so arranged that, even should an operator neglect to properly operate one of the keys, in grouping or splitting positions, the group of trunks controlled by that key will not be isolated and left unattached, but will be sure to be associated with one or other of the divisions created by operation of the keys.

29. *Operation of Pilot and Night Alarm Circuits.*

Pilot and Night Alarm circuits are provided, the pilot lamp operating with the trunk guard lamps and the night alarm circuit giving an audible signal when the pilot lamp lights, provided the night alarm key has been operated.

30. *General.*

Attention is called to the following principal features incorporated in this set-

(*Continued on page* 50.)

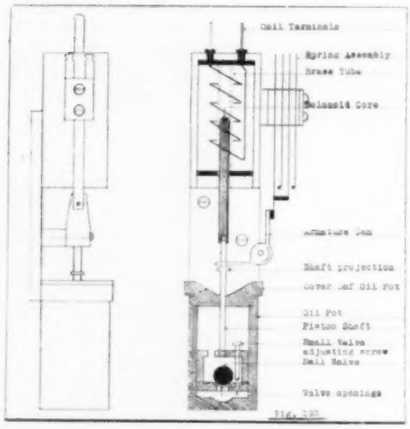
Studying Telephone Methods

This Is Chapter 38 of a Series of Articles Written by E. R. Collins, Manitoba Telephone System, Brandon, Canada.

Faults appearing on a Manual Switchboard are easily detected by the telephone operator. The Automatic type of equipment must, however, be able to point out its faults quickly to the party in charge of the equipment. The equipment used to give the alarm is called the Supervisory Equipment. In large exchanges this eqiupment is laid out in groups, centering on a common panel. But the 100 line system would have all the supervisory equipment included in its assembly.

Dash Pot Relay.

At this time we introduce a new type of relay in our study; that is, the Dash Pot Relay. The construction of this relay is shown in Fig. 293. There are two main parts, the Solonoid, and the Dash Pot. The current flowing in the Solonoid winding would naturally pull the core in instantly. But for reasons appearing as we progress, we do not want this to take place. Rather we need to have the plunger enter the Solonoid slowly. Therefore



we attach to the lower end the Dash Pot. This consists of a cylinder and a piston. The piston has two valve openings. The large one in the center of the piston is covered by a steel ball. Suppose the piston is already at the upper end of the cylinder, and is allowed to drop. The steel ball rolls aside as the oil in the cylinder flows up through the large opening. Therefore the downward motion of the piston will be quick. The small valve is adjustable by means of the adjusting screw which closes the opening. If the screw is turned in close, the opening will be very small. Now, if the piston is pulled up the steel ball will close the large valve and prevent the oil now above the piston from flowing through this opening. The small opening is the only one left, and more time will be required to allow the oil to pass through this opening to the under side of the piston. The time required then to make the upward stroke can be regulated by the adjusting screw. Due to the fact that as the piston is pulled up, a vacuum will be formed under the piston, which will suck the oil down through the valve. Therefore the oil will not be forced up through the opening for the piston shaft.

An armature cam and a set of contact springs are now mounted on the side of the relay frame. The armature cam projects in on either side of the shaft. The slot in the cam allows the shaft to move up freely. There is a projection of the shaft which will engage the cam and lifting up the inner end will naturally force the contact springs out into their contacting position. The housing of the solonoid forms a complete magnetic circuit around the coil. The only break in the field will be the center of the coil. Therefore the solonoid plunger is pulled in with maximum force in an attempt to complete the magnetic field. The Dash Pot can be adjusted then to complete its upward motion in, say, 15 seconds, or 30 seconds. The piston must be close fitting, and yet be free of any binding. A special grade of oil is used, so that the time of operation will not vary greatly with temperature.

Fig. 295 shows the circuit arrangement where this type of relay is used in connection with the 100 line switchboard.

Supervisory Ground Circuit.

There are two types of alarm provided for and operated through the dash pot relay; that is, the release of the connectors and the operation of the master switch and line switches.

We have already studied the equivalent of Fig. 294, but we will give it again, for the study of the supervisory circuit. There is a supervisory relay commonly called the *supervisory ground* relay. This has two windings, one 1300 ohms, and the other 2 ohms. The values of these resistances may vary with different installations. However, the values of the resistances given in these drawings are sufficiently close for purposes of study.

Battery flowing from the locking magnet (Fig. 294) finds its ground through

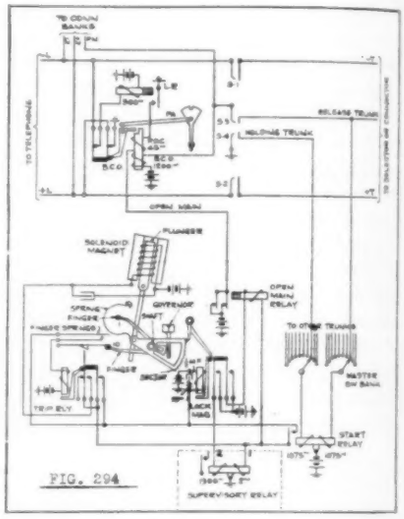


FIG. 294

the 1300 ohm. winding of the supervisory relay. Therefore, every time the master switch trip relay operates, the supervisory relay will also operate. Should this locking magnate remain pulled up the master switch is in an off normal condition. The open main relay will also be pulled up, cutting off the pull down coil battery from all the line switches. Therefore, we require an alarm for this condition.

If the contacts 3-4 of the locking magnet (count contacts out from the coil) should stick the master switch might appear normal, but the open main relay will be pulled up. Therefore, the open main relay finds its ground through the 2 ohm. winding of the supervisory relay giving us an alarm at this point.

The master switch solonoid battery finds its ground through the make contacts of the trip relay, and the 2 ohm. winding of the supervisory relay. If this had been taken through the 1300 ohm. winding, we would still get the alarm, but the 1300 ohm. coil would not allow enough current to flow to operate the solonoid. Therefore the 2 ohm. winding must be used. The trip relay finds a circuit to the supervisory relay either

CONVENTION SCHEDULE.

Indiana Telephone Association, Indianapolis, Claypool Hotel, May 6 and 7.

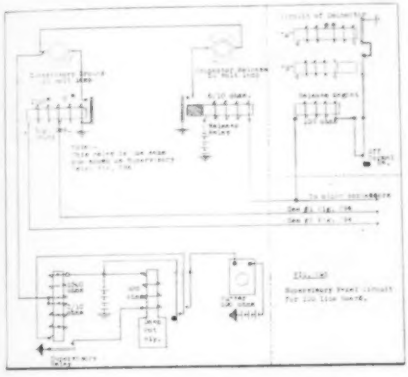
Kansas Telephone Association, Topeka, Hotel Jayhawk, May 13, 14 and 15.

Up-State Telephone Association of New York, Rochester, May 21, 22 and 23.

Pennsylvania State Telephone & Traffic Association, Penn-Harris Hotel, Harrisburg, May 13, 14 and 15.

through the starting relay contacts or by contacts 3 and 4 of the trip relay. Therefore, either of these contacts sticking will bring on the supervisory alarm. Again the contacts of the starting relay might be closed, and yet the locking magnet might fail to operate. Here again we have our alarm circuit through the 2 ohm. winding.

The ground circuit at the line relay marked L. R. should be brought to ground through the 2 ohm. winding of the supervisory relay. Then if the line relay operates, but the plunger of the line switch is stuck, then we would also get an alarm for this condition. The supervisory relay shown in Fig. 294 is shown again in Fig. 295. We have shown this relay in Fig. 294 in dotted lines on this account.



Connector Release Circuit.

Battery for the release magnets of the connectors is supplied to the connectors of the 100 line board through a common release relay. If any release magnet operates then the release relay supplying the battery will also operate. This relay is low resistance, so that all the release magnets fed by this relay will be able to secure sufficient current if they should all release at the same time. The release relay will then pull in every time the release circuit of a connector is closed. A sample of this circuit is shown in Fig. 295. Battery flows from the release relay through the off normal switch make contacts, the "B" relay normal contacts, the normal contacts of Relay "A" to ground. Should the wipers of a connector stick through faulty adjustment, the release magnet will hold in.

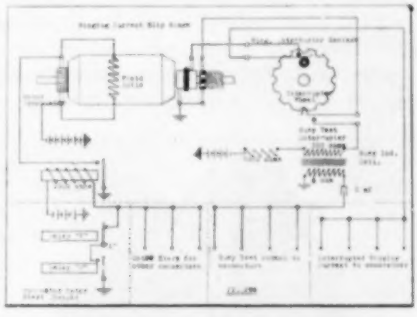
If the pulling up of the supervisory relay and the release relay operated an alarm, there would be alarms given when no trouble was present. In the lower part of Fig. 295 we have shown a dash pot relay and also a double wound relay. Suppose the release relay pulls in. Battery would flow through the 1300 ohm winding of the supervisory relay through the release lamp to ground at the release relay. But there is not enough current flowing in the 1300 ohm winding to allow the lamp to light. There would be about 3/10 of an ampere flowing through the lamp. But the armature of the supervisory relay pulls in with this current flow, and its armature completed the battery circuit through the dash pot relay. If this relay is adjusted for 30 seconds, then in that time it will complete its stroke and close its contacts. This closes a circuit to a 500 ohm buzzer which will give the alarm. It also supplies battery through its make contacts, through the 3/10 ohm winding of the supervisory relay, through the release lamp to ground at the release relay which is still pulled in. Now the lamp will light due to the low resistance of the supervisory relay circuit closed by the dash pot. Thus we do not complete the buzzer alarm or light the signal lamp till the time period determined is up. The same operation holds good for the *supervisory ground relay*. This will light the supervisory ground lamp, however, instead of the release lamp. This shows the attendant who answers the buzzer that the trouble is either the connectors if the release lamp burns, or in the master switch or line switches if the supervisory ground relay burns. Different colored lamps are used to make a quick distinction between the classes of alarms. This prevents loss of time locating the trouble.

Ringing and Busy Current Supply.

Ringing Current for a small board might be supplied by an interrupter, or a rotary machine. A very compact type of machine is shown in the circuit of Fig. 296. This supplies an interrupted ringing current and also the busy tone. The motor side of the machine is battery operated, therefore we do not want to waste battery current running a machine when not required. Therefore, the connector circuit provides means of starting the ringing machine. When the connector goes into the ringing position the "F" relay is normal and the "H" relay is pulled in. Therefore, an extra set of contacts in these two relays as shown in Fig. 296 will do this for us. As soon as the "H" relay operates battery from the motor start relay flows to ground through the normal contact of Relay "F" and the make contact of Relay "H" and operates the armature of the motor start relay. This closes a circuit for battery from the motor side of the ringing machine to ground at the motor start relay. We could depend on the ground at the Relay "H" of the connector to start the motor without the motor start relay. But as the motor requires a good current supply it is best to place the heavy duty contacts on one relay than on one for each connector.

The alternating current for ringing at 20 cycles per second and approximately 100 volts, is supplied by the secondary coils of the armature. These are connected to a pair of slip rings and the current led off by means of a pair of graphite brushes. The output from the generator side might be 100 volts, or if a lower voltage is given it can be stepped up to 100 volts by a suitable transformer. We have not shown the transformer in our drawing.

Mounted at right angles to the armature shaft of the ringing machine is a gear wheel. This gear wheel meshes with the worm gear shown on the right end of the armature shaft. The gear wheel turns at a much lower speed than the main shaft. On the same shaft with the slow moving gear wheel is a cam wheel. This is shown in Fig. 296. The cam wheel may be made of fibre so that the busy springs shown at the lower side do not make electrical contact. The outer edge of this cam wheel is notched so that as the upper busy spring drops into a slot it breaks contact with its mate and makes when out of the notch. There is a pin and insulator set in the face of this cam wheel. Once each revolution this causes the ringing interrupter springs to make contact. The time of contact is *one-half second*, followed by 2½ seconds of silence. This causes any telephones being called to have a repeated ring timed as above.



There is a segment wheel mounted on the shaft of the generator, which makes and breaks battery fed through the primary of an induction coil, and a 3000 ohm resistance. This sets up a high frequency buzz. The interrupted current is again interrupted in periods by the busy test interrupter. This gives a series of high frequency tones which are used for the busy test. Now we strike a snag. If a busy line is called the "H" relay of the connector will not pull in. Therefore, the ringing machine will not start, and the subscriber gets neither a busy or induced ring back. Therefore, our method of starting the ringing machine must be wrong. As a common point of operation the motor start springs might be included in the off normal switch. Then as soon as the shaft becomes off normal the motor will commence whether the called line is busy or not. For a little practice draw a spring assembly for the off normal to do this. Or we might include another pair of springs in the "G" relay of the connector, connected to the armature of the "F" relay as shown at "X" in Fig. 296. Then the motor would start with

either the "H" relay ringing a non-busy line, or the "G" relay giving the busy for a busy line. If the off normal alone was used, the motor would continue to run as long as any connector was off normal. Using the "H" and "G" relays to ground the motor start relay would allow the motor to stop as soon as the called subscriber answered. If a busy line is called the subscriber would not hold the line very long. The writer has not a drawing of a private automatic exchange con-

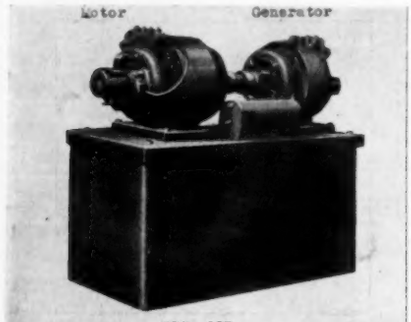


FIG. 297

nector, but for study of general principles it does not matter. It is good practice to work out some of these problems regardless of general practice. It all helps to understand more clearly the actual circuit arrangement of your own equipment. The secondary of the busy induction coil is low in resistance. This is to cut down the strength of the busy tone to a point of comfort for the subscriber. A 2 M.F. condenser is included in the common busy supply. The secondary of the busy coil is grounded and if you refer to the connector drawing in the January issue you will note that battery from the negative winding of the "D" relay would find a path through the induction coil to ground if the condenser were not included. This would cause a connector to hang up on a busy line as the "D" relay would not release.

Automatic Voltage Control of Batteries.

In Fig. 297 we have a cut of a motor generator set used to charge the batteries for this 100 line board we are discussing. The motor may be driven from either A. C. or D. C. and the voltage to suit the power supply. The generator develops about 65 volts of direct current. The charging rate is controlled by the rheostat in series with the field winding of the generator. As this machine is to have an automatic control the charging rate must be adjusted with this rheostat, and then the rheostat is locked in a fixed position.

In Fig. 298 we have a set of 4 relays which are the voltage control relays. Then there is a solonoid switch to connect the generator to the batteries for charging, and when in a normal position the upper blades of this switch make contact with contacts 1 and 2 of the solonoid switch in the upper section of Fig. 298. We will discuss this apparatus first. The solonoid consists of two windings, one of very low resistance and a few turns, shown by the heavy lines. The other winding is of a relatively high resistance and is connected permanently across the terminals of the generator. The battery is in two sections. We have shown 25 cells of battery in one bank, and then 3 cells called counter cells connected in opposite polarity at the upper end of the bank. The regular battery plates are filled with a compound which gives the plates the ability to hold a large body of energy. The counter cells are simply lead plates with no compound and while the counter cells will develop a voltage the same as the regular cells, they have no storage capacity. Therefore, if we short circuit the three counter cells, they lose their charge of current in a few seconds. If we were to short circuit three ordinary cells fully charged we would have some fireworks.

The solonoid plunger is normally held in contact with studs 1 and 2. In this position you will see that the three counter cells are short circuited. A coil spring which is adjustable holds the solonoid plunger in this position. Now suppose the generator is started. The voltage will rise in the generator, and there will be a flow of current in the high winding of the solonoid or the pull down coil. The plunger will not pull down due to the pressure of the spring until the voltage of the generator has risen higher than the voltage of the battery. Now the contacts 3 and 4 of the solonoid switch will be connected as shown in Fig. 298 and will allow the battery to flow up through the heavy coil and through the battery. Now the current enters the two windings at the center, and flows in such a manner that the two windings are assisting one another. This gives additional pull to the contact blades. The greater the charging rate the heavier the contact pressure. This is as it should be. Now the voltage of the 25 cells will immediately start to rise, causing an increase of voltage on the bus bars of the switchboard. We do not want this to happen, so we have the counter cells opposing the battery of the main bank. This leaves the voltage across the switchboard about normal again. Now, suppose the generator is stopped. Then the voltage of the generator will drop gradually, until it is below the voltage of the battery. Immediately this happens, the battery reverses and flows down through the series coil in the opposite direction as shown by the arrows alongside the series winding. This will oppose the falling voltage of the generator and will allow the spring to raise the blades into contact with 1 and 2 of the solonoid switch. This cuts the one side of the generator away from the battery and at the same time places a short circuit across the counter cells, causing them to lose their charge. In this way the switchboard voltage is maintained between 46 and 52 volts.

Starting and Stopping Switch.

The starting and stopping switch for the motor is located at the lower right hand of Fig. 298. This consists of two

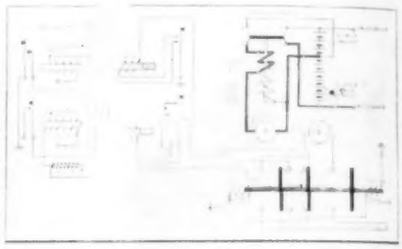


Fig. 298.

solonoids mounted on a frame. A common plunger operates when either solonoid is energized. Mounted on the plunger are three switch blades carefully insulated from each other and from the plunger. Blades "A" and "B" make contact with the contacts 1 and 2 and 3 and 4 of the starting switch. Blade "C" makes contact with either 5 and 6 or 7 and 8 contacts. The wiping surface of these contacts is wider than the contacts for Blades "A" and "B." In its present position the starting switch is in its off position. start solonoid is connected to contact 8 and by blade "C" to contact 7 and then to Relay "A" of the voltage control group. If this solonoid is energized, the plunger will drive to the left

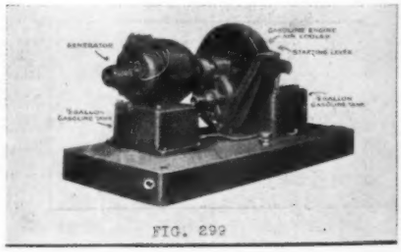


FIG. 299

and connect Blade "A" to contacts 1 and 2, and connect Blade "B" to contacts 3 and 4. This connects 110 volts current supply to the motor generator set. Blade "C" has now been transferred to contact with 5 and 6 contacts. This completed the circuit from the stop solonoid to Relay "B" of the voltage control set.

Voltage Control Relays.

There two relays, the high and low voltage s. Relay "high" is adjusted to pull up its armature when the voltage is . The low relay is adjusted to let go armature if the voltage drops to 46. e will suppose the voltage has dropped to 46. Then the armature of the low relay releases. Now battery can flow from the start solonoid over contacts 8 and 7 through the 4 ohm winding

(*Continued on page* 42.)

The Chicago Long Distance Toll Board

By E. O. NEUBAUER[1] and G. A. RUTGERS[1]
Associate Member Non-Member

The growth of the long distance telephone traffic, along with many improvements in service, has brought about recently certain significant changes in operating practice. Now, in the majority of instances, the long distance toll user may remain at the instrument during the complete progress of his call. From the standpoint of simplicity and convenience to the user this, together with a reduction in the time interval between the placing of the call and the answer of the distant station, from a former average of six to a present average of less than three minutes, brings long distance and local service very closely together.

The accomplishment of this change required careful planning and supervision throughout the Bell System but except in the larger cities did not involve relatively large or expensive equipment rearrangements. Conditions were such at Chicago, however, that the change in practice, together with preparations in connection with the continuing toll volume increase, made it advisable to replace part and remodel the remainder of the existing toll switchboard equipment.

Such action at so large a center constituted a major problem in telephone engineering. It included also various operating and equipment features which, being of the most recent type available, made the new office one of the most complete advanced and within the system. This paper describes action in the new installation and the general operating and toll circuit layout, prefacing this description with a brief outline of the general relationship of the toll plant to that of the system as a whole.

The General Telephone System

The telephone system is composed of local exchanges with direct completion of calls between stations within the local exchange boundaries and with switched toll line completion of calls between exchanges. As to plant standards and methods of operation, it is unified so that its whole system is as accessible to any one station as to any other, regardless of sizes of exchanges or their remoteness from each other.

At each local wire center the lines or loops from all subscribers' stations, for purposes of their direct interconnection, are brought to one central office switchboard. If, as in large metropolitan areas, this concentration involves too extensive a wire haul, the geographical group is split up into economic sub-areas with sub-wire centers connected together by direct local trunks.

This same general arrangement is supplied for inter-city or toll connections. Adjacent and neighborhood communities are connected by direct toll lines, and more widely separated cities receive their toll service through selected toll centers or switching points strategically located throughout the system's territory.

Each toll office is a focus for all originating and terminating toll business from and to its tributary local offices, and the effect of this toll centering is to concentrate toll traffic into units large enough to permit the most economical balance between the costs of the switching operations and the costs of the toll line plant.

The Chicago toll office, at one of the great regional centers of this country, is a key switching point within the country-wide network of toll lines and serves directly the 32 local wire centers with 102 central offices and five suburban wire centers which together form the Chicago Metropolitan Area. Within this area during the year 1929 some 1,200,000 stations will have originated approximately 7,300,000 calls via this toll board, in addition to some 44,500,000 calls which will have been handled by the Chicago local offices to nearby toll points.

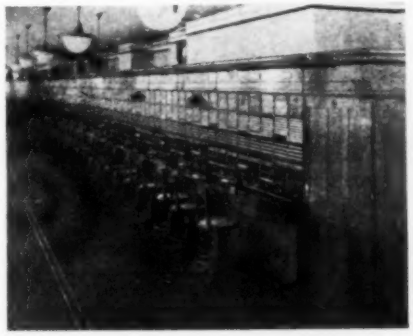


Fig. 1—A line of CLR (combined line and recording) switchboard

The Work of the Toll Operator

Under the toll centering arrangement, the local and tributary offices are connected with their toll office by groups of recording and toll switching trunks. Prior to the change in the method of toll operation already referred to, the recording trunks terminated on separate recording positions, and a special recording operator worked to secure only the necessary details of the call from the calling subscriber. She then released the subscriber's line and passed a ticket memorandum of the call to separate completing operators at an outgoing switchboard line. These operators re-secured the subscriber over toll switching trunks, reached the distant station over the toll lines, and then established the connection and timed the call.

With the change in method, the recording and completing or "line" operators' functions have been combined and located entirely upon the outgoing switchboard. To indicate this mehod of combined line and recording work, an expression, "CLR," has been coined telephonically and will be used as such throughout the paper.

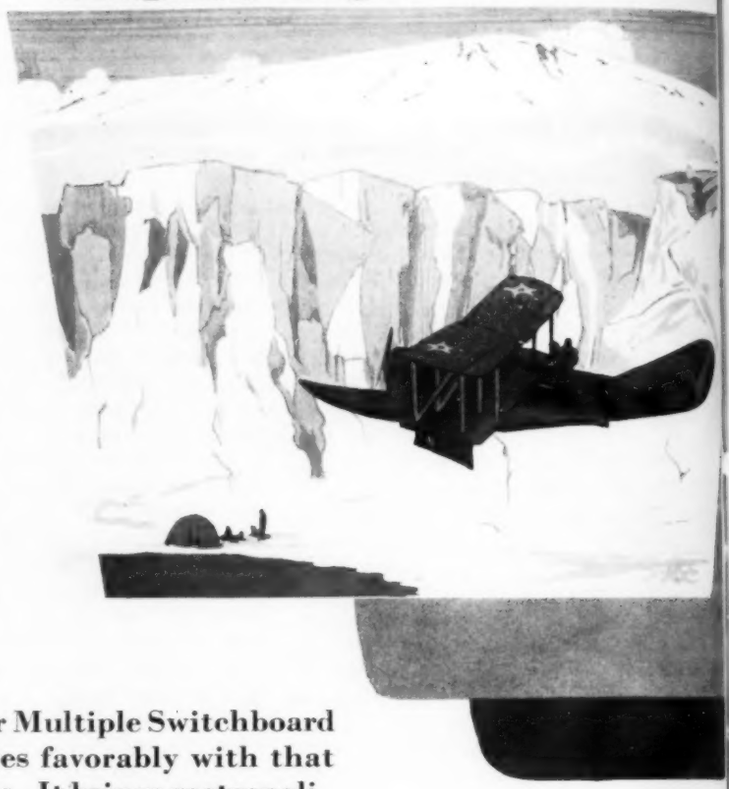
Since provision must be made for incoming as well as outgoing traffic, and for toll center to toll center switching, we shall generally find that the larger toll switchboards are divided into three groups, or lines; for CLR or originating business, for "inward" or terminating business, and for "through" or switched business. As in Chicago, there are apt to be also various additional special groups to meet the functional requirements of such large toll line and toll volume concentrations as are there encountered.

In handling a CLR call from a manual subscriber, the CLR operator makes a permanent ticket record of the call details and then, without releasing the subscriber from the recording trunk, rings out over an idle toll line to the distant operator, using a separate pair of cords and asking for the station called. While waiting for the called station's answer, she secures the calling subscriber's line over a toll switching trunk, using the same pair of cords used to ring out over the toll line, and releasing the recording trunk. Upon receipt of an answer by the called station, she stamps the ticket with the time in hours, minutes, and seconds with a calculagraph stamp, and upon receipt of the final disconnect signal, stamps the time when conversation ended. Billing is finally made upon the basis of charges applied to the elapsed time indicated on the ticket.

One of the chief savings in time to the subscriber under this procedure as compared to the former separate recording and completing operation is the sav-

[1]Both of the Illinois Bell Telephone Co., Chicago, Ill. Abridgment of a paper presented at the Great Lakes District Meeting of the A. I. E. E., Chicago, Ill., Dec. 2–4, 1929.

It's a matter o



The modern aeroplane fuselage, to stand the strains placed upon it, must be made entirely of steel and welded into one structure.

Similar ruggedness of construction is employed in making the Stromberg-Carlson Junior Multiple Switchboard. This switchboard is now made with a steel frame section which gives a continuous face switchboard without wood strips intervening between the sections and permits an ultimate capacity of 800 lines.

The Stromberg-Carlson Junior Multiple Switchboard furnishes service that compares favorably with that supplied by the big city systems. It brings metropolitan telephone service to the small community.

Being manufactured in standardized units, economies are effected that keep the cost of the switchboard at a point where the small exchange can operate it at a profit.

Stromberg-Carlson engineers will gladly send you descriptive matter explaining why the Stromberg-Carlson Junior Multiple Switchboard is the ideal telephone switching equipment for the small office.

Write for Bulletin 135

Stromberg

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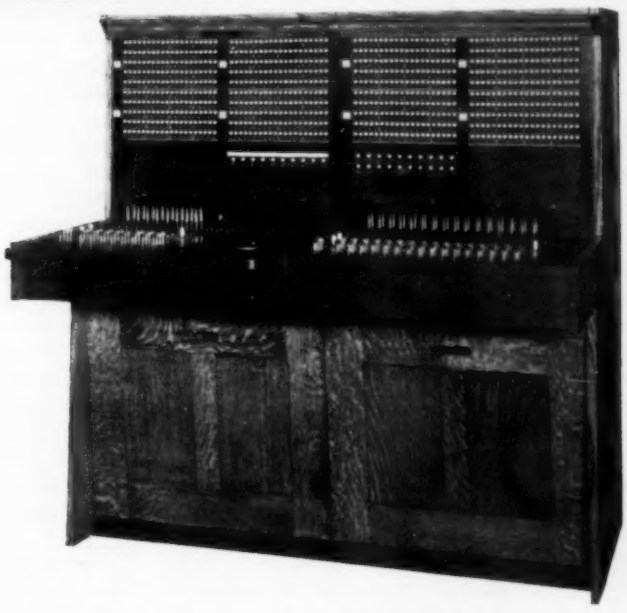

Stromberg-Carlson Junior Multiple Switchboard Installations

Furnish modern service at low cost.
Effect substantial savings in the cost of telephones.
Reduce expense of dry cells.
Supply fast and accurate service.
Permit close supervision.
Provide uniform transmission.
Increase operator efficiency.

Big city service for the small office at a profit

Pacific Coast Representative
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Branch Offices:
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Southern Representative
Scoville Mercantile
Company
Atlanta, Ga.

g~ Carlson

ing in ticket distribution time between the two sets of operators.

Reciprocal work must be done at the terminating end of each originating connection by an inward operator who answers the incoming toll line signal and reaches and rings the station called by the originating toll operator. In handling switched calls, the intermediate or through operator deals only with the distant toll operators who reach each other over toll lines routed via the intermediate toll center board, these lines being connected together at the through positions by the through operator.

Toll calls are handled on the basis of connection with a particular person (a person-to-person call) or with someone who may answer at the station called (a station-to-station call). Either class of service is available to the subscriber whether he calls by name or by number. When anyone will suffice, the call is necessarily completed upon the answer of the station called and will be delayed only by a "don't answer" or "busy" condition at the station called, or by toll circuit congestion. On a person-to-person call, the inability to reach immediately the one person desired at the telephone may cause delay in addition to the above causes.

The various operations required to secure completion under conditions of postponement involve many different methods and routines which are rather technical in their applications and require additional distributions of the ticket memoranda and various specialization of work.

The Chicago Toll Board

An example of the specialization required is given in the following tabulation of the Chicago Toll Board positions:

(a) CLR	301
(b) Non Method	233
(c) Utility	78
(d) Inward	89
(e) Through	113
Total general	814
(f) Directory	44
(g) Routing	16
(h) Delay quoting	4
(i) Traffic trouble	4
(j) Office "B"	6
Total miscellaneous	74
(k) Ticket distributing	24
(l) Ticket filing	24
(m) Service supervisor	16
(n) Service observing	20
(o) Monitor tap	1
Total auxiliary	85
Total tandem	16

These switchboards, which are grouped upon six floors of one building centrally located in the downtown business district of Chicago and designed for an initial service of some 32,000 toll board calls per day, are arranged to accommodate the following line and trunk equipments:

1. Toll line to all points.....2700
2. Switching trunks to local offices..3800
3. Recording trunks from local offices. 850
4. Miscellaneous interboard trunks..1200

Total network.....8550

Each of the switchboard position and line group arrangements has specific functions which are somewhat abstract for the scope of this paper. Certain controlling factors, however, should be pointed out here as follows:

Subgrouping and Tandem Arrangements. The capacity of the face equipment of the CLR boards is insufficient to accommodate the whole of the recording and switching trunks on a workable basis. The CLR group, therefore, has

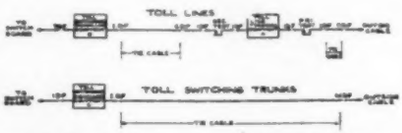

Fig. 4—Diagram Showing Routing of Lines from Outside Cable to Switchboard

CDF = combination distributing frame; *IDF* = intermediate distributing frame; *MDF* = main distributing frame

been subgrouped into four units, each of which serves as a specific subdivision of the Chicago local offices.

In spite of various measures taken to reduce the space requirements for front equipment at the CLR position, it did not appear practicable to provide appearances for all of the toll lines at each CLR position. Therefore, a trucking plan which introduces a toll line switching on tandem board within the office itself is necessary and the CLR operators thus reach a majority of the toll lines needed by them on a trunking basis. One of the lines of CLR positions is shown in Fig. 1. This line consists of 65 positions.

Directory and Routing Arrangements. More than 2100 directories covering 350 metropolitan areas and communities extending from coast to coast are indexed and filed on a state basis at a line of director switchboards. The CLR, or other service operators, communicate with the directory operators by trunks without delay for such telephone number information as cannot be furnished by the subscriber himself.

At certain other positions other operators specialize in quoting the routes to points not obtainable on a direct connection basis. These routines are based on frequent and through traffic engineering studies of the entire toll network throughout the territory involved.

Pneumatic Tube System. Because of the location of the various switchboards on several floors, it is necessary that means for rapidly transmitting tickets from one location to another be provided. An exhaust blower, a system of flat brass tubes, and ticket distributing positions comprise a pneumatic tube system for this purpose. With one end folded to form a pocket for the tube air currents, the tickets are inserted at any position and delivered to control or distributing positions where they are checked and routed to their proper destination. Either roller or hand receiving valves permit ticket egress at the terminal points.

Engineering Problem Involved. Consideration of the situation at the Chicago center had established the fact that the increasing toll volume growths would require equipment floor space in excess of that which could be made available without additional building operations. In 1926 it appeared that the rather appreciable equipment additions required for growth and those required to permit of change to CLR operation would tend to advance the new building work and would require new switchboard line arrangements to permit this to be readily carried out.

At this same time, new and improved toll switchboards of a more efficient type were being made available, and it was desirable to utilize this type even though they could not be used in conjunction with the existing type boards without appreciable modifications within the latter. After proper engineering cost study and management consideration, these various factors combined to indicate that the dismantling losses upon part of the existing switchboards and the new money requirements could be justified on the basis of improved efficiencies in service and over-all economies in providing for future growth. Since a clear path for future building work could also be secured, it was decided that the old switchboard be practically replaced.

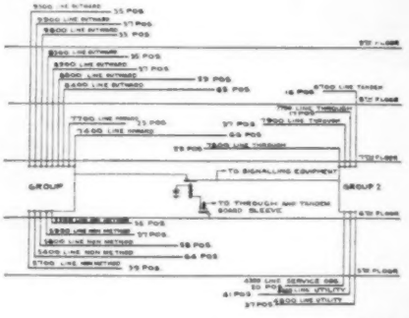

Fig. 5—Diagram Showing Connection for Multiple Cut-Off

The general building conditions were such that the new switchboards, when completed, would to a great extent be occupying the old switchboard space, and yet service upon the old boards must be kept up on a continuous basis. This was met by the invention of special "applique" circuits, attachable to the old board circuits to make them workable with the new board circuits. By this means, as installation work proceeded, the old and new were placed side by side and the service was continuous and yet made ready for cut-over.

The problem in connection with the congested face equipment space of the CLR boards which, as already mentioned, resulted in a toll tandem board arrangement, brought into service an entirely new development designed especially for metropolitan CLR offices.

It was felt also that all other equipment or operating improvements available should be included in this one big project. Under this head came the terminal repeater pad arrangement to eliminate cord circuit repeaters, and this was added to the already complicated plans for Chicago.

Under normal conditions, each step in the development of new equipment and operating methods is worked out in a preliminary manner and given a complete workout on a trial basis. If satisfactory, requirements then are worked out on the basis of manufacturing production and given to the field. Field engineering considers these in connection with existing and potential conditions and includes them in cost and other studies which result in detailed specifications. Then the manufacturing company carries out its detailed engineering and manufacture in accordance, ships the material, and installs it.

Toll Line Equipment. The replacing of No. 3 type of toll switchboard has its toll line signaling units included with the toll line circuit, thus omitting them from the cord circuits in the switchboard and in many cases eliminating the association of ringers with the toll line terminal equipment. This feature required the development of the "applique" devices for use in working old and new sections temporarily together, as already referred to. Fig. 4 shows the arrangement of equipment and cross-connections in a toll line and toll switching trunk.

In line with the switchboard replacement, all of the existing toll lines at Chicago required practically complete retermination and realignment, while on a working basis to meet both old and new condition. This covered some 3122 signaling units, 2450 toll line circuits and 974 two-wire and 1210 four-wire repeaters with their associated networks and equipments. A feature of this work was the necessary coordination by many distant toll line offices and their terminal arrangements.

Repeater Pad Control. For many years necessary amplification of the speech currents on toll circuits switched at the toll office for the longer distances has been provided by the use of manually-operated repeaters of the cord circuit type available for insertion in the line as required. Under the conversion at Chicago, these were completely displaced.

The plan carried out to displace the cord circuit repeaters and to obviate certain operating difficulties requires the operation of the toll lines at transmission equivalents low enough to permit switching without cord circuit repeaters. Since, in many toll lines, this would involve noise and crosstalk when they are used on terminal connections, the power level of such a line when used for a terminating connection is reduced by the insertion of a pad. The plan, therefore, requires circuit arrangements so that the pad will remain in the line when it is used on a terminal connection but will be removed from the line when it is switched to another toll line on a via connection.

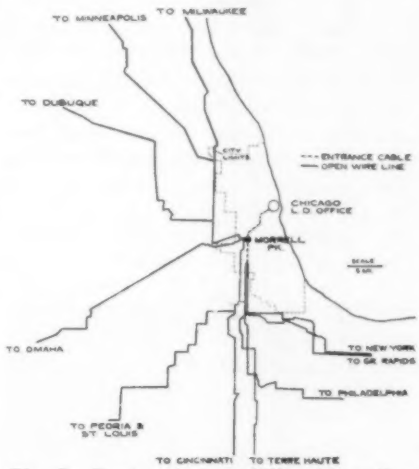

Fig. 7—Route of Open-Wire Lines Entering Chicago

Multiple Cut-off. Where the boards are located on several floors, the amount of wiring necessary to connect lines in a large switchboard installation introduces transmission losses due to the bridged multiple; this is objectionable. Arrangements have been made, therefore, to cut off some of the boards for through connections, and this is accomplished by so wiring the switchboards that they may be divided into two groups; (1) those at which switches to other toll lines are never made, and (2) those at which switches to other toll lines are made. A relay system is then provided so that when a circuit is taken up at any position of group (2), the multiple of the positions in group (1) is cut off. This arrangement is shown diagrammatically in Fig. 5.

Testing

The testing and correcting of troubles on lines and equipment in so large a concentration requires appreciable specialization. A total of 46 primary and 20 secondary units of No. 5 type toll test board is provided for this purpose, with segregation between toll cable and toll open wire terminations. The primary units test against outside, and the secondary units against inside office trouble.

In addition to the routine tests made at frequent intervals by the maintenance people, routines have been set up for reporting the trouble of various kinds which are noted by the operators. These provide for the prompt reporting of all such troubles to the proper plant maintenance people who take immediate steps to clear up any unsatisfactory conditions.

Power Plant. The toll line terminal equipment requires two 24-volt batteries arranged in parallel with a 6400-ampere hour capacity and a present peak load of 850 amperes; 130-volt storage battery unit, with a 640-ampere hour capacity and a peak load of 75 amperes for the plate voltage of vacuum tubes and for telegraph, and two 1000-cycle and two 135-cycle generators to supply the necessary alternating current for signaling purposes.

The toll switchboard equipment is operated by another 24-volt storage battery unit with an existing peak load of 1350 amperes; a 28-volt battery used for busy signals, with a 1900-ampere drain in the busy hour a 130-volt battery for vacuum tube plate current with a 1.5-ampere drain and a 48-volt battery for special circuits with a 5-ampere drain. All of these batteries are maintained on a continuous float basis and are provided with voltage regulators. Dc. power supply operates the charging generators. Alternating ringer current for signaling purposes is here supplied by four 1000-cycle, two 135-cycle and two 20-cycle ringing generators.

The exhauster used for operating the pneumatic tube system is operated by an 85-hp. motor with a speed of approximately 3500 rev. per min.

Toll Line Facilities. The Chicago toll office is the center for 20 toll cables entering over six main underground routes and terminating 1949 quads on the cable test boards.

There are in addition 152 open-wire circuits which reach the open wire test board after their preliminary transfer at the city limits to necessary underground toll entrance cables. The routing of the open wire lines is shown in Fig. 7.

At the toll open wire entrance point there are now installed, therefore, besides the necessary open wire termianl equipment and 132 telephone repeaters, 192 channels of carrier telegraph and 37 systems of telephone carrier.

In addition to the 1400 toll lines now in service within toll cables there are 590 telegraph channels in service in these same cables. Of these 300 are superimposed on wires used simultaneously for telephone circuits and the remaining 290 are provided upon carrier current channels on wires which cannot simultaneously be used for talking purposes.

Within this toll system plan, the continual objectives are those of simplification and improvement in methods, increase in speed and accuracy of service, more complete efficiency in the provision and use of plant, and uniformity of transmission between all points.

Underground Cable Construction

Pulling Cable from Manholes to Poles — Lubrication of Cable — Pulling-In Cable—Arranging Cable for Splicing—Cable Distribution—Where Underground Cable Is Justified. Another Interesting Article by Ray Blain.

After the duct line and manholes have all been finished we can well consider that the greater and most difficult part of the underground cable job is completed. The placing of the cable is more in line of general telephone work and it is quite common practice in the larger cities at the present time for telephone companies to turn work of laying conduit and building of manholes over to a general contractor and the telephone company completing the job by pulling in the cable and splicing. Conditions and requirements incident to the placing of the cable will now be considered.

Lateral Riser Pipes

Where cable is taken out of a manhole up a pole or to a block cable terminal on a building, wrought iron conduit is generally used. In some cases the pipe is bent in a long sweep to a right angle where it changes from a horizontal to a vertical run. This is a satisfactory arrangement for use with small cables, but for the larger sizes it is best to provide an elbow designed for the purpose. An elbow or a pipe bent for cables larger than 50 pair should have a radius of not less than 30 inches.

The cable should always be protected from mechanical injury for a distance of about 6 to 8 feet above the ground level on a pole or building. The general practice is to use an ordinary iron pipe for this purpose with a lead cap on the top to close the opening between the pipe and the cable.

The riser pipe with lead cap at the top has never been considered entirely satisfactory on several counts. In many cases the lead sheath of the cable is softened where the cap is soldered to it and a case of trouble frequently results. Neither is it any picnic to pull a cable through a 6-foot riser pipe on a pole or building without damaging the lead sheath. It is the present practice of some companies to make use of a split pipe which is cleated over the cable to protect and hold it to the pole or building and with the top left open. The bottom of this split pipe will rest on the reducer provided on the approved type iron elbow. With this arrangement the required amount of cable can be pulled through the elbow and the pipe clamped over it later. This is much easier and quicker than pulling through a length of riser pipe. Fig. No. 12 pictures the old and new type riser types installed. The split pipe can be clamped to the pole or building with ordinary pipe straps or with special clamps provided for the purpose.

Fig. 13 pictures a large riser pipe where the underground takes aerial distribution through a cross-connecting box.

Rodding Duct

A line of some sort must be placed in each conduit for pulling in the cable. Some prefer to pull a piece of iron wire through each section of the conduit as it is being laid. The general practice, however, is to rod the duct line after it has been completed. Standard conduit rods should be used for this purpose which are constructed of short pieces of hardwood coupled with a sutiable metal joint

Fig. 12—Old and new style riser pipes

easily connected. The first section is usually equipped with rollers so that it will pass over small pieces of mortar or other small obstructions without difficulty. The first section of rod is inserted in the duct and pushed in its full length when the second section is coupled on. This operation is repeated until the next manhole is reached. If the conduit sections are lined up properly in the manholes as mentioned in previous article, the line can be attached to the end section of the duct rod and the complete section of the coupled rods pushed on through to the next manhole in the line. This operation can be repeated until the end manhole is reached when the rods are uncoupled as they are pulled through the last section of the run.

Conduit rods should be considered a necessity in all exchanges that have any amount of underground cable in service, as it is almost impossible to place a line in any length of conduit without them. On a section no longer than two or three hundred feet it is possible to run a fish tape through after much work and delay but in longer sections this is impossible. A good set of conduit rods will prove a valuable investment in any exchange. When no duct rods were available I have seen the method of attaching a large cork to a heavy twine and floating through the duct section with a hose supplying the water. While this method is possible and a lot of fun it is slow and cumbersome and not to be considered from an efficiency standpoint.

I have heard of cases where a ferret was used to draw a line through a duct which was claimed to be sure and fast. While this may be true I have never met any ferrets in the telephone business and don't believe that any of the makeshift methods are near as satisfactory as a duct rod which should pay for itself many times over in time saved on any cable job of average size.

After a line has been pulled into a new duct it is always a good plan to pull a mandrel or conduit cleaner through it to remove any small obstructions or sharp edges that might injure the lead sheath of the cable when it is pulled in.

Lubrication of Cable

Cable should always be well lubricated in some manner as it is pulled into the duct line. Soap stone, grease, graphite, old automobile oil and many other forms of lubrication have been used, but various tests have indicated that powdered soapstone is the best for all purposes. Soapstone has the additional advantages of being cheap and clean. A good arrangement for applying the soapstone is to attach a piece of flexible conduit, of the type used for housewiring, to an ordinary tin funnel of a convenient size and play a small stream on top of the cable at the point of entering the duct.

Some may argue that lubrication is not necessary, but tests made by the aid of a dynamometer have proved that the pulling-in strain can be reduced more than one-half by proper lubrication. Considering the expense and delay involved when a cable is lost in a conduit, a pull should never be made without first lubricating properly.

Pulling-In Cable

After the completion of the duct system the next and perhaps the most im-

portant part of the entire job is to pull the cables into the ducts in a suitable manner for splicing. The cable reel cart as mentioned in Aerial Cable Construction is just as necessary for underground cable, but if not available cable jacks can of course be used. The reel after the lagging has been removed should be placed on the side of the manhole toward the section that the cable is going to be pulled into and set up so that the cable comes off the top. With this arrangement the cable should take a graceful

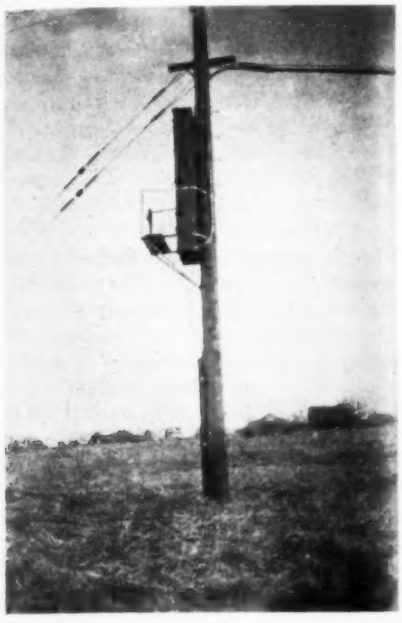

Fig. 13—*Riser pipe and cross-connecting box*

bend and be easily guided into the duct line. The reel should be placed very close, in fact partly over, the manhole opening in order to enter the duct properly without danger of damaging the lead sheath. It is generally necessary to turn the reel slowly by hand while the cable is being pulled in. I always prefer the use of duct shields on the end that cable enters the conduit. These shields are inexpensive and often prevent injury to the cable.

Manila rope can be used to pull cable into the duct but if much of this work is to be done it is best to provide a flexible steel cable of suitable length, which is safer and does the job better. This steel rope should be attached to a standard wire grip with a suitable open link and the wire grip to the cable. Every precaution should be taken to make sure that the line is properly connected to the cable so that it will not slip to safeguard against the loss of cable after it has been pulled part way into the conduit. A wire hitch or a line attached to the conductors might not be used on an aerial cable with comparative safety as there the loss of a line is not so serious, but when pulling underground nothing less than a good woven wire grip should ever be considered. These are inexpensive and sizes to fit various sizes of cable should be in storerooms of all progressive telephone companies.

If manila rope is used for pulling cable suitable pulleys must be provided to prevent its chafing over edges of the manhole frame. If a power winch of the usual design is used for pulling, which is always advisable, it is generally an easy matter to make a direct pull from the snatch block on the pulling-in iron to the drum of the winch if possible to set up near the manhole. Another argument for the winch, which is generally mounted on a truck, is that there are no running lines to obstruct traffic which are always dangerous.

When a power winch is not available a direct pull from a truck or a steady pulling team can be used if care is taken. When the direct pull method is used it will perhaps be necessary to provide a manhole skid for use at the pulling end. These skids can be purchased at a reasonable cost or can be made up locally from two pieces of about 2 by 4 inches hardwood timbers eight to ten feet long. Holes should be drilled through these about four inches apart several feet from each end. Bolts are slipped through the holes and can be adjusted to fit different sized manholes by shifting the pulleys on the bolts. These skids will last longer if the edges are bound with strap iron.

The pulling-in speed of the cable should never be more than 100 feet per minute and 50 feet per minute is generally fast enough and much safer. At least two men should be left on duty at the reel and they should make sure that no imperfections in the sheath are pulled into the duct. Should any doubtful points be noted the reel should be stopped, the defect examined thoroughly and any

Fig. 14—*Manhole guard and danger signal*

necessary repairs made. Suitable signals should be arranged between the men at the reel and the ones opertaing the winch or truck so that the pull can be stopped immediately at any point required.

Safety Precautions

When pulling in cable every safety precaution possible should be observed to prevent injury to the public which otherwise generally result in expensive settlements for the telephone company. All open manholes should be protected with an approved type of manhole guard, preferably, painted red. In busy streets it is also advisable to place suitable flags or danger signals to warn automobile traffic. On some streets it may even be advisable to place a watchman at the manhole guard on each street opening. All obstructions left in the streets at night should be protected with red lanterns or flares. Fig. No. 14 represents an approved type of manhole guard and it is always advisable to provide a sufficient number of them on every job.

Arranging Cable for Splicing

After a section of cable has been pulled in and sufficient length of cable left at

For Underground Cable Construction Tools
use the "Cope"
Cable Rack Conduit Rod
Bond Plate Bond Wire
Winch Capstan
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Catalogue on request. etc., etc.
T. J. COPE
Manufacturers of
Complete Equipment for Cable Installation
19 So. LaSalle Street, Chicago, Ill. 6122 Vine Street, Philadelphia, Pa.

each end for forming and splicing in the manhole the ends should be thoroughly sealed with solder. Where the woven wire grip was attached to the pulled end if there is any indication of the lead sheath being damaged, or, if previously sealed and the lead seal has loosened, the end should be cut off and resealed to guard against the possible entrance of moisture.

The forming of cable in a manhole is no easy task and can generally be done best by the cable splicer. Short bends that will flatten the cable should always be avoided. Generally cables larger than 50 pair should not be bent sharper than about 12 inches. Stub cables can generally be formed outside the manhole much easier than inside. Splices should always be arranged if possible so that not more than two cables come out of each end of the sleeve. Cable benders are of great assistance in forming large cables in manholes. The one which consists of a large coil spring which if slipped over the cable will permit a regulation bend without flattening the sheath.

If it is necessary to seal the ducts to prevent flow of water into a manhole this should be done before the splicer starts work. Vacant ducts can easily be sealed by the use of a wooden plug driven in them. These plugs should be first soaked in water and then wrapped in cheese cloth before being driven into the duct. Working ducts can be sealed by packing oakum around the cable and then sealing with any of the approved type compounds.

Every precaution should be taken to make sure that manholes do not contain gas or dead air before sending workmen in them. This gas is colorless and odorless but is very dangerous. Indications of the presence of this gas are noticed by difficulty in breathing, ears start ringing and eyes burn. Manholes known to contain gas should be thoroughly ventilated before sending workmen in them. This ventilation can be accomplished by one of the portable blowers pictured in Fig. 15. In the picture the blower was being used to blow air over two fire pots to heat the manhole in extreme cold weather. For ventilation purposes only the fire pots are of course eliminated.

Cable Distribution

The distribution of the underground cable plant should be planned with the utmost care. Main cables should in most cases be about twice the capacity needed at the time of installation. In many cases cables even larger will prove more economical in the long run. This is necessary so that extensions can be made and additional laterals cut on without the expensive operation of running new cable all the way back to the main frame. Ordinarily main cables will have "Y" splices in every manhole in the average small exchange. It may be that at the time of installation some manholes will not require the lateral to meet immediate needs. In some cases it may be good practice to connect a stub cable in the manhole of the size or even larger than the proposed lateral so that the main cable need not be disturbed when additional facilities are required. Ordinarily there will be a splice in the main cables in all manholes anyway and the connection of the stub will not require much additional work or expense.

All dead pairs in main cables should be spliced through to the extreme ends of all cables or laterals so they will be available for use at any point required. The cable plant and its distribution should always be arranged so as to be as flexible as possible. By this I mean that there should be a minimum of cases where

Fig. 15—Blower being used to ventilate and heat manhole

cable cuts are necessary to provide additional facilities one place and less at another. But when a cable cut is necessary if the plant is properly engineered it should be made with a minimum of splices, throws or count changes.

Where Underground Cable Is Justified

I know of a case recently where it had become necessary to replace a heavy aerial cable and much argument took place as to whether it should be a new aerial or underground. Aerial was finally decided upon as its immediate cost was considerably less than underground. I feel that this particular company made a mistake as the greater part of the pole lead is along an important street that has recently been equipped with a white way lighting system and in many cases the telephone poles come within a few feet of the ornamental lamp posts. There is not much doubt but that before the natural life of the new cable has expired all poles will be ruled off this particular street.

Open House Proves Popular and Interesting

Unique exhibits, one a cross section of a city street in a residential section, depicting every detail in the transmission of a telephone conversation, and others contrasting antique telephone equipment with that of today, were important attractions of the two-day open house staged by The Home Telephone and Telegraph Company, Fort Wayne, Indiana, February 26 and 27. More than 2,000 persons attended the affair.

The Anthony and Harrison offices and garage and warehouse building of The Home company were thrown open for inspection during the two days, but the exhibits were concentrated at the Anthony office, the down town building.

The first exhibit, the cross section of the city street, occupied one portion of the main lobby. This exhibit, 43 feet long, six feet deep and six feet wide, won immediate attention. The intricate operation and route of a telephone call was graphically shown. Every detail in the transmission of voice from one telephone to another was outlined. The display was landscaped and included pools of water, fountains, grass and trees. Below this scenery, the earth's surface, showing plainly the manholes, conduits, cables and poles, was realistically built and illustrated.

In the center was installed central office equipment, showing the automatic switches. These could be seen in operation when the visitors or employes acting as guides dialed, ringing a nearby telephone. It was also possible for visitors within a few feet of each other to talk over telephone. Nearby was a 1200 pair cable, fanned out. Seated below this was an employe engaged in splicing, wrapping and explaining the details of cable work.

The visitors were then conducted to the second floor and into the switchroom, where employes grouped and conducted them through, explaining the equipment. This equipment was placarded. The signs and ensuing explanations gave the guests brief but intelligent descriptions of the equipment.

On this same floor, exhibit tables were

Unique display arranged for open house exhibition

arranged. Many interesting antique telephone models labeled with historical data were on view. Replicas of the first acoustic telephones; others made in foreign countries and many American telephone inventions were prominent.

The response of the public to the open house was highly encouraging. Many of the attractive baskets of flowers which lent beauty to the inner building were sent to the company by friends.

New Type of Television

Westinghouse Reviews New Type of Television Which May Be Viewed by Large Audience. The Use of a Cathode Ray Tube as Receiver Adds Many Advantages to Newest Invention

Television which can be viewed by a room full of spectators rather than by one or two was announced recently by Dr. Vladimir Zworykin, research engineer of the Westinghouse Electric and Manufacturing Company, to members of the Institute of Radio Engineers. The use of a cathode ray tube as a receiver gives this new type of television many advantages over the well known scanning disc method of visual broadcasting.

The inventor is already in position to discuss the practical possibility of flashing the images on a motion picture screen so that large audiences can receive television broadcasts of important events immediately after a film of these is printed. These visual broadcasts would be synchronized with sound.

The cathode ray television receiver has no moving parts, making it more easily usable by the rank and file of the radio audience. It is quiet in operation and synchronization of transmitter and receiver is accomplished easily, even when using a single radio channel.

Another advantage is that, using a fluorescent screen, the persistence of the eye's vision is aided and it is possible to reduce the number of pictures shown each second without noticeable flickering. This in turn allows a greater number of scanning lines and results in the picture being produced in greater detail without increasing the width of the radio channel.

The apparatus described by Dr. Zworykin is now being used in experimental form in the Westinghouse research laboratories in East Pittsburgh. A number of similar receivers are being constructed in order to give the set a thorough field test through station KDKA, Pittsburgh, which already is operating a daily television broadcast schedule with the scanning disc type of transmission.

The pictures formed by the cathode ray receiver are four by five inches in size. They can be made larger or brighter by increasing the voltage used in the receiver.

The transmitter of this new television apparatus consists of a motion picture projector rebuilt so that the film to be broadcast passes downward at a constant speed. This film is scanned horizontally by a tiny beam of light which after passing through the film is focussed as a stationary spot on a photo-electric cell. The scanning motion of the beam is produced by a vibrating mirror which deflects the light from one side of the film to the other.

Dr. Zworykin was forced to develop an entirely new type of cathode ray tube for his receiving apparatus which he calls a "kinescope." In this tube a pencil of electrons is bombarding a screen of fluorescent material. The pencil follows the movement of the scanning light beam in the transmitter while its intensity is regulated by the strength of the impulses received from the transmitter. The movement of the scanning beam, consequently of the cathode ray pencil, is so rapid that the eye receives a perfect impression of a continuous miniature motion picture.

A reflecting mirror mounted on the receiver permits the picture to be observed by a number of spectators.

This condensed description of the methods used by Dr. Zworykin to effect television transmission can give only an idea of the possibilities of the new system. To the radio public it means, when perfected, a means of television which will be simple to operate because it has no scanning disc or other moving mechanical part. The receiver will operate in silence, offering no interference to sound broadcasts.

To the radio engineer the invention is important for the same reasons and because it will not be wasteful of radio wave bands. This because the transmitter and receiver can be synchronized using but one channel.

The name of Dr. Zworykin is not new to the radio public. Earlier this year he was brought into the limelight in connection with his facsimile transmitting device for telegraphing photographs, letters, drawings and documents.

SOLDER

I visited a telephone exchange recently and commented on the appearance of the switchboard which was of a well known manufacturer, fairly new and from all indications not more than three or four years old. I was promptly advised that it was "No good" and had never given service. I knew this particular type switchboard was good and that there was no reason why it should give trouble. Examination revealed that they were having trouble but not due to any defect in the design or material of the board. This company had installed the board themselves and trouble was all due to defective soldeing. The cables in the multiple were all neatly formed and the insulation of the skinners were not raveled. There was enough solder on each joint and the holes in the terminals were all filled but almost every wire was loose in the solder. In other words the solder just didn't bond. Now there are a number of things that might have caused this. Perhaps they used a cheap grade of solder which contained impurities, the wire was not cleaned so that it would tin properly, or they made use of a dirty or cold copper. A common and frequent mistake is that the hot copper is not held long enough on a joint to heat the metals up so that they can be joined by the solder properly.

Now this company bought a good switchboard, planned its installation well and did a perfect job except one small detail and that was they made the mistake of not soldering properly. Proper soldering may to some mean only a small detail but when it can make or break a telephone company to me it means something important if not as big as an elephant. I believe that soldering is the most important thing in a telephone exchange and to me it is not how many joints a man makes in a day, but how many he makes that are well soldered so that they will give service. Without solder we would sure have some terrible telephone service.

Each little joint must be soldered well,
For if they are not the service will tell.
And if they are not, in just a short spell,
The angry subscribers will start raising hell.

RAY BLAIN.

27 Countries in Phone Directory

An international telephone directory printed in English, French and German has just been issued by a Danish company. It covers telephones in twenty-seven European countries and is said to be the first of its kind ever printed.

May Is Convention Month

During the month of May three important state conventions are to be held. They are:

Indiana, Indianapolis, May 7-8.

Pennsylvania, Harrisburg, May 13-14-15.

New York, Rochester, May 21-22-23.

Stromberg-Carlson Net Earnings Break Record

Annual Statement of the Stromberg-Carlson Telephone Manufacturing Makes Best Showing in the History of that Organization

Not only were all earning records broken by the Stromberg-Carlson Telephone Manufacturing Company last year, according to the report mailed recently to stockholders, but 1930 is running substantially ahead of the banner year, and promises to exceed 1929.

Net profits for 1929, after provision for Federal taxes, interest, reserves for depreciation, and all other charges in keeping with the soundest accounting practices, were $1,070,055.58. The previous record year was 1926, when profits totalled $971,262.97.

Notwithstanding the fact that the first six months of 1929 presented a new peak in the business of the nation, January business this year was 80 per cent greater in volume than the corresponding month last year, February this year was greater by 40 per cent than February, 1929, and March, up to the present time, is running 30 per cent ahead of March, 1929.

"These are truly remarkable statistics, in view of the present economic situation and the trend of business," said George A. Scoville, vice-president in charge of sales, and Wesley M. Angle vice-president and secretary, in commenting on the condition of the company, in the absence of W. Roy McCanne, president and General manager, who with Mrs. McCanne, is taking a European trip.

At present the company employs 1,534 persons in Rochester. This compares with 1,348 at this time last year, and 959 in 1927.

In the last fifteen years the company has shown an average increase in business of 20 per cent annually. Since the new company was formed in 1914, a dividend rate, once established, has always been maintained or bettered.

The strong financial condition of the company is reflected in its consolidated balance sheet, covering the Rochester Company and its Canadian and Australian subsidiaries. The Canadian Company did $750,000 business last year and made a new high record in January of this year. The consolidated balance sheet audited by Price Waterhouse and Company, shows that the total assets of the company are $9,681,612.72, including $316,-614.94 in cash, $107,705.39 in notes receivable, $2,769,184.89 in accounts receivable, less reserve, and $3,535,515.01 in raw materials, supplies, work in process, and finished products at the lower of cost or market.

Of the earnings of $1,070,055.58 last year, $65,001.73 was paid in dividends on the preferred stock, and $334,476.74 in dividends on common stock, including two extras; and the balance of the earnings or $670,577.11 has been added to surplus, bringing the surplus up to $3,047,428.86 as of December 31. This is earned surplus and is significant of the sound financial position of the company. Besides this unappropriated surplus, a reserve of surplus amounting to $500,000 has been set up from earnings for investment in addition to property. In arriving at these figures adequate reserves have been established against raw materials and piece parts.

In addition to the net profits of $1,070,-055.58 last year, a reserve of $200,000, which was at December 31, 1928 known as a reserve for market fluctuations in inventory values and applied directly against inventory to reduce it to the lower of cost or market, has been freed from such application and is now treated as an allocation of surplus described as a reserve for contingencies.

These net profits of $1,070,055.58 work out to just under $4.00 a share, and if the $200,000.00 mentioned above were considered as representing additional earnings for 1929, the per share earnings would become proportionally greater.

Both Mr. Angle and Mr. Scoville asserted that the company has never been in a better position than today, nor had its prospects been more promising. They stated that all radio sets on hand were "live merchandise." In spite of the market crash of October and November of 1929, the company reached its greatest amount of sales for any one month in October, fell only slightly behind that record in November and finished the year with a good December.

The volume of business in 1929 was $12,500,000 and this compares with $10,-000,000 in 1926, the previous record year for earnings. Heavy expenses were incurred last year in moving into the new $1,500,000 plant, which contains 360,000 square feet of manufacturing space and is regarded as a model of its kind.

New and more efficient machinery has replaced much of the older equipment, departments have been arranged and equipped to afford the best possible opportunity for efficient and high quality production, and under the guidance of Edward A. Hanover, vice-president in charge of production, the factory is ready to meet any demands made on it. With the expense of moving behind the company, an equal amount of business should make possible greater earnings for 1930, both Mr. Angle and Mr. Scoville said.

Another $100,000 was added to the advertising appropriation last year and it cost the company $250,000 to put the concerts of the well known Rochester Civic Orchestra on the Blue radio network. The company likewise maintained its popular Station WHAM, the expense involved in its maintenance and in putting out the nation wide weekly Stromberg-Carlson program, being regarded as well spent for the furtherance of the company's position in the radio industry.

An adjoining plot of land of fifteen acres has been purchased for $100,000 to assure room for future expansion. Extensive experimental work is being conducted in the laboratories under the direction of Ray H. Manson, vice-president in charge of engineering of the company. The company is licensed under all groups of radio patents, giving it complete freedom of manufacturing and placing it on the ground floor for any development in the industry. Besides, the company is making extensive experiments and has a number of developments ahead of it both in radio and telephone apparatus.

This combination of radio and telephony is unique, but highly advantageous to the company and its customers in both kinds of apparatus, for the peaks of the radio and telephonic manufacturing activities come at different times of the year, and the combination gives stability to the employment of the company's workers and makes it more possible to meet peak demands that come in either line.

The most conservative merchandise policy has been adopted, states Mr. Scoville. The company has avoided the pitfalls connected with mushroom expansion. It has had thirty-five years experience in the manufacture of products for voice transmission, the present development of radio voice transmission apparatus being just one step in its progress. Never in its history have its prod-

(*Continued on page* 42.)

TO GIVE THE PEOPLE THE MODERN, CONVENIENT TELEPHONE SERVICE THAT THEY NEED

The Bell Telephone Company . . . of your town

An Advertisement of the American Telephone and Telegraph Company

IT HAS its home in your town. Its operators are the daughters of your neighbors. Its various departments are in the hands of your own citizens, with years of training in telephone engineering and management. Who owns the Bell System? 450,000 people scattered over the United States own the stock of the American Telephone and Telegraph Company and 250,000 own other securities of the Bell System.

No matter how small the part of the Bell System that serves you, it has behind it research, engineering and manufacture on a national scale. The Bell System operates through 24 companies, each designed to fit the particular area it serves—to furnish the highest standard of service in a manner personal to the needs of every user.

Serving each of these 24 operating companies is the staff of the American Telephone and Telegraph Company, which is constantly developing better methods of telephone communication. Each draws on the findings of the Bell Laboratories, one of the greatest institutions of its kind in the world, for the continual scientific improvement of telephone service.

Each has the benefit of the buying power and specialized manufacturing processes of the Western Electric Company, which supplies telephone apparatus of the highest quality and precision for the entire Bell System.

Each takes advantage of every improvement in practice, equipment and economy.

The Bell System's ideal is to give all of the people of this nation the kind of modern, convenient telephone service that they want, over its wires to connect them one with another and with the telephones of the rest of the world. It is your telephone company, at your service with every resource that it commands.

Oklahoma Holds Large Convention

The most successful Convention in the history of Oklahoma Utilities Association was held at Tulsa, Okla., March 11, 12 and 13 in the New Hotel Tulsa. Registration broke all former records, reaching 1,130 on the final day, and interest was sustained until the closing session.

General sessions were held in the forenoons and division meetings in the afternoons, the telephone division however also holding morning sessions with the exception of the first day. The Telephone, Electric Light & Power, Gas, Electric Railway, Public Relations and Manufacturers' divisions and the Safety Section, each held separate afternoon meetings in which matters of special interest to the particular branch of the industry were presented in addresses and discussions.

On the closing day the following association officers were elected to serve until the 1931 convention to be held next March in Oklahoma City: President, T. H. Steffens, Sand Springs, president Sand Springs Railway Co.; first vice president, S. I. McElhoes, Oklahoma City, vice president, Southwestern Light & Power Co.; second vice president, R. J. Benzel, Oklahoma City, general manager, Southwestern Bell Telephone Co.; treasurer (re-elected), W. R. Emerson, Oklahoma City, secretary-treasurer, Oklahoma Gas and Electric Co., and manager (re-elected), E. F. McKay, Oklahoma City. Each division also elected a division chairman and representatives on the executive board of the association. The following telephone division officers were elected: Members of executive board, Samuel Hand, Beggs, manager, Beggs Telephone Co., and E. E. Mills, Garber, district manager Western Telephone Corporation of Oklahoma; division chairman, W. O. Mills, Skiatook, division superintendent, Standard Telephone and Telegraph Company.

The telephone division adopted resolutions thanking all who participated in making the meetings of the division a success, including all speakers on the program from outside the state. Among familiar faces from outside the state were, C. C. Deering of Chicago, secretary-treasurer of the United States Telephone association, who addressed the general session of the telephone division, and Miss Anne Barnes of Des Moines, Ia., traveling traffic supervisor, United States Independent Telephone Association, who conducted a traffic conference in the telephone division and also delivered an address. Among the new visitors from outside the state were A. R. MacKinnon, Topeka, Kansas secretary of the Kansas Telephone Association and a brother of F. B. MacKinnon of Chicago, president of the United States Independent Telephone Association; and S. A. Lane of Little Rock, Ark., president West Arkansas Telephone Co.

The telephone division appointed a committee to study and report on right-of-way matters in the state highway department and to study rural line service problems. Members of this committee are: Chairman, W. O. Mills, Skiatook, district supt., Standard Telephone and Telegraph Co.; E. E. Miles, Garber, dist. mgr. Western Telephone Corp.; Herb. J. Clark, Salina, Kans., general manager, Western Telephone Corp.; L. W. Scherer, Watonga, president, United Telephone Corp.; R. J. Benzel, Okhaloma City, general manager, Southwestern Bell Telephone Co.; C. J. Bain, San Antonio, Tex., president, Oklahoma Associated Telephone Co.; J. W. Walton, Broken Arrow, president, Oklahoma Telephone Co., J. M. Keffer, Shattuck, district manager, Standard Telephone Co. of Texas; E. E. Noe, Welch, president, Welch-Bluejacket Telephone Co.; D. P. Strickland, Dallas, Tex., vice-president and general manager, Southwest Telephone Co.; Mark A. Sanders, Oklahoma City, connecting company agent, Southwestern Bell Telephone Co., and H. W. Hubenthal, Oklahoma City, engineer, Oklahoma Utilities Association.

WERE you convinced that a 7-inch plier could give your linemen all they wanted in a practical working tool, would you hesitate to buy 7-inch MASTER Pliers upon a strict business basis of value, economy and utility?

Masters are not pliers in the ordinary sense—they are power multiplying mechanisms put to the purposes of pliers.

The old principle of the lever and fulcrum—as expressed in crow-bars and as used in ordinary pliers—is doubled — compounded — in Master Pliers—an exclusive Master Plier feature.

MASTER 7-inch
ideal for telephone work

We make the conservative claim that a linemen's grip-cutting-power is doubled with Masters—that cuts are made with 50 percent less effort—that heavy cuts requiring double power with lap-joint pliers are made with no more effort than ordinary cuts—resolved into the perfectly safe statement—that a Master 7-inch will do all and more than any other 8-inch on telephone work.

Mathematical calculations—substantiated by engineering laboratory tests and hundreds of reports by users amply support our claim.

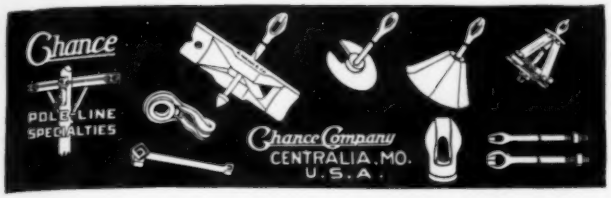
If, from a service standpoint, a Master 7-inch will do all your linemen ever require—there are real business reasons for your company buying the Master 7-inch size.

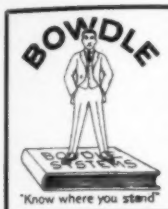
Let us send you more information on these efficient, economical, long-lasting tools with our no-risk offer. Then you can investigate for your company without obligation or expense. Merely send the coupon or write.

MASTER PLIER CORP., FOREST PARK, ILL. Send offer TE-4

Name..... Street.....

Town..... State.....



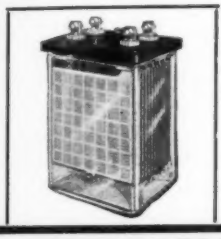


Investigate Our Centralized Accounting Plan

This monthly Audit will save you lots of money and give you important information that you should have about your business—the best of all business, if properly managed.

BOWDLE ACCOUNTING SYSTEM

CERRO GORDO ILLINOIS



For Every Job

Dependable battery operation is imperative to uninterrupted telephone service.

Exides are dependable. Thirty-five years of service in the telephone industry have proven that. Dependable Exides assure a long life of satisfactory service.

DEPENDABLE EXIDE BATTERIES

Exide BATTERIES

The Electric Storage Battery Company

Philadelphia Penna.

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

EVER-PROTECT CABLE COMPOUND

TRADE MARK REG. U.S. PAT. OFF.

National Cable Compound Co.

Incorporated

MITCHELL - - IND.

Note Protection at Corners

Blake Insulated Staples

Trade Mark

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

Blake Signal & Mfg. Co.

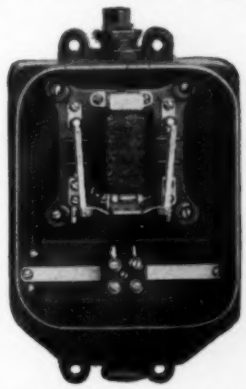
BOSTON, MASS.

SIGNAL ENGINEERING RELAYS

for Telephone Installations

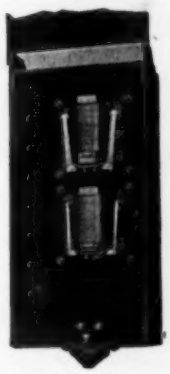
Used by Bell Telephone Companies

Extension Ringing Sets for Audible and Visible Signaling



Relay Mounted in Weatherproof Housing

Telephone Locking Relay Sets for Taxi Cab Calling and Police Calling



Mounted in Non-Weatherproof Housing

Closing of ringing circuit energizes sensitive telephone relay, contacts of which carry lighting current to energize heavy duty relay (upper), locking in contacts to bell or lamp. Push Button release.

SIGNAL

ENGINEERING & MFG. CO.

142 WEST 14TH STREET, NEW YORK

Branches: Boston, Detroit, Seattle, Chicago, Los Angeles, San Francisco.

"Wonderful Growth Because of Wonderful Equipment"

Beginning four years ago with a wealth of knowledge, but with a moderate capital, the James R. Kearney Corporation of St. Louis has attained a reputation experienced by few concerns of the country. Within a span of forty-eight months this concern has built up an annual business in excess of one million dollars. This information was revealed at a recent meeting of the stockholders in the offices at St. Louis.

Anchors are probably the chief products manufactured by this company for use by telephone and telegraph companies throughout the United States and Canada; recently the James R. Kearney Corporation, Limited, of Canada, was incorporated in order to supply Kearney products to that section. Besides anchors a number of other very useful articles are manufactured by this organization.

The founder of this concern, James R. Kearney, began his career in 1892 as a lineman and has continued the work and study in all its phases because he realized that the telephone and telegraphic business of the country would require many improvements to make service what the talking world would require. So he began to make a survey of the needs to better these defects. And many of the lines along the highways and railways owe their uniformity to the Kearney anchor.

James R. Kearney, President, James R. Kearney Corporation

James R. Kearney, Jr., vice-president, James R. Kearney Corporation

"The fundamental of our sales policy," states James R. Kearney, president, "is the golden rule. I am not saying that just for effect. We mean it. The customer is always right. If he isn't, he won't take advantage of you very long because his conscience won't let him. Standing instructions to salesmen are, if a complaint comes from a customer in their territory to drop everything, find out what the trouble is and make it right.

"If an order comes into this office and isn't filled in three days it comes to my desk and I find out why. Service, efficient and prompt, is what modern business must have."

Traveling as an electric salesman for years, Kearney gained the friendship of utility executives all over the nation. Many of these men have become his best patrons since he founded his own company.

"Another factor in our growth," he said, "was that in the last few years foreign utility concerns have been coming to this country for engineers; I knew many of these engineers from my old salesman days. I was able, therefore, to get a friendly hearing for my company's products. The engineers knew they could depend upon my word as to the merit of what I sold and that I would stand back of my goods. That has helped."

The company started with five employes. It now has 400. Besides the St. Louis plant, it has a factory at Taylorville, Ill., and last month organized the James R. Kearney Corporation, Limited, of Canada, to build and operate a Canadian factory. The company's officers, besides Kearney, are:

Thomas B. Bash, Elon J. De Right and Walter A. Heinrich, vice-presidents; James R. Kearney, Jr., vice-president and secretary, and Allen B. Williams, treasurer; James Daly is vice-president and directing manager of the Canadian company.

Petroleum Industry Association to Meet in Dallas

The Petroleum Industry Electrical Association will hold their annual meeting in Dallas, Texas, at the Baker hotel, April 21 and 22.

This Association is now composed of nineteen major oil, gas and pipe line companies, with thirty-eight representatives, and is having a healthy growth.

The officers are T. J. McMahon, president, the Texas Pipe Line Co., Houston, Tex.

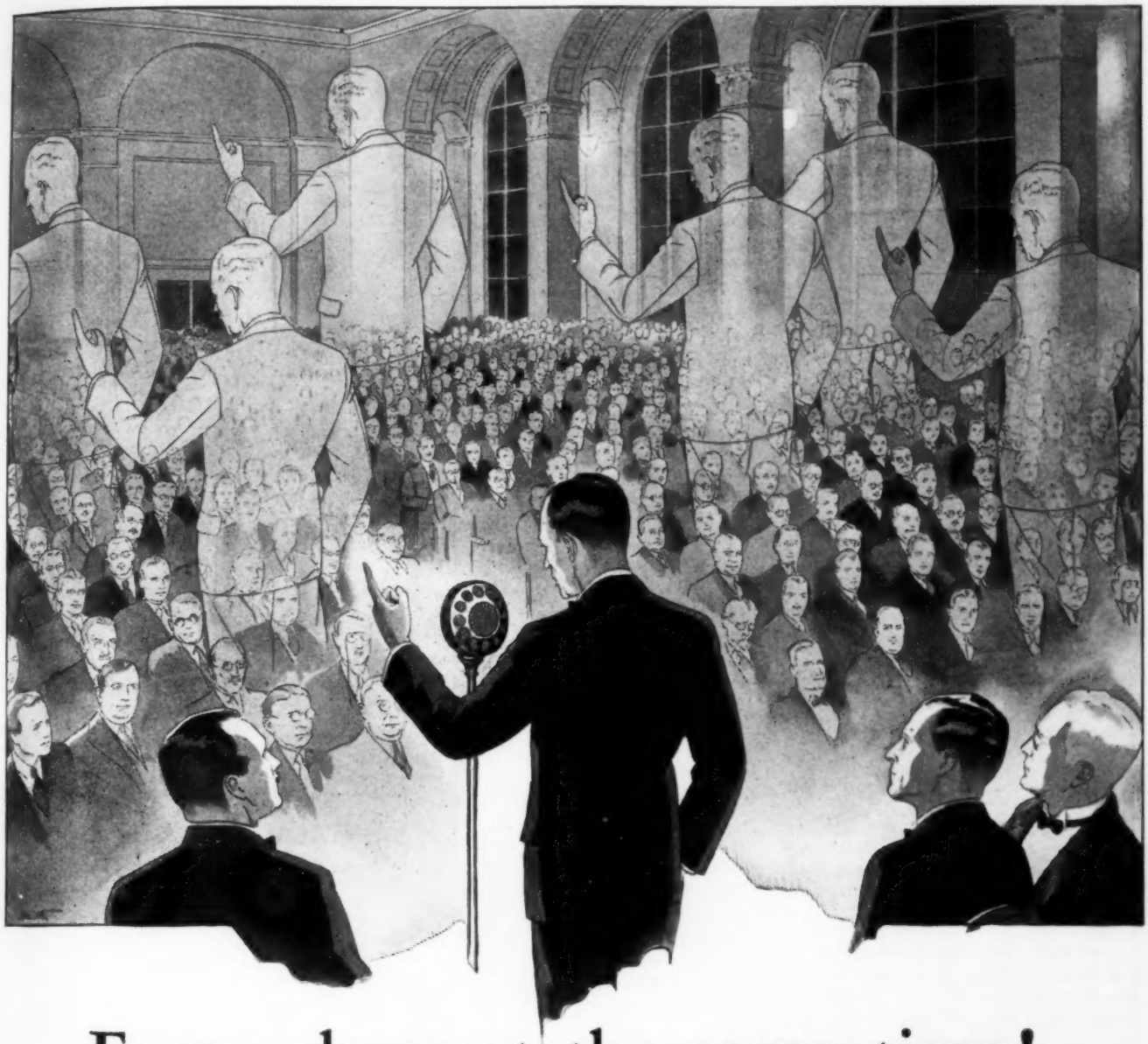
F. S. Leonard, vice-president, Shell Pipe Line Corp., St. Louis, Mo.; C. E. Foster, second vice-president, Oklahoma Pipe Line Co., Muskogee, Okla.; H. E. Browne, secretary, the Prairie Pipe Line Co., Independence, Kan.; W. T. Bulla, treasurer, the Empire Companies, Bartlesville, Okla.

The object is to harmonize and coordinate the principals and practices of the oil industry with respect to their construction, maintenance and operation of their power, telegraph and telephone communicating systems. For mutual benefits among its members and everything pertaining to electrical or communicating systems.

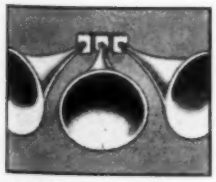
The Association is enjoying a healthy growth and we expect a number of new additions during the coming year.

Retires as Southwestern Bell President

Retirement of E. D. Nims of St. Louis, as president of the Southwestern Bell Telephone Company, has been announced. Mr. Nims becomes chairman of the board and has been succeeded as president by Albert B. Elias, former first vice-president of the company. Mr. Nims entered the telephone business in Oklahoma at Perry thirty-two years ago. He, with three partners, linked together three small towns which became the nucleus of the Southwestern Bell Telephone system in Oklahoma, which now has 153 exchanges in the state and serves approximately 210,000 telephones. Mr. Nims was also the organizing genius of the entire Southwestern Bell Telephone system which serves 1,353,000 telephones in Missouri, Kansas, Texas, Arkansas and Oklahoma.



Everywhere at the same time!



Public Address System brings speaker right to you — The speaker rises—and the Western Electric installation in the huge room transforms him into a score of speakers! No matter how far away from him you sit, his every word comes to you as distinctly as though he stood right beside your chair.

Committees arranging banquets or conventions find that meetings are more interesting and effective when held in hotels where the Public Address System widens the hearing circle.

This equipment is a miniature interior broadcasting station, transmitting speech, music and entertainment *within* a building—to as many rooms as desired. Patrons of hotels thus equipped find an added attraction in getting music "on tap" in their rooms via loud speaker.

In up-to-date schools, hospitals, railroad stations and amusement parks, too, you will find the Public Address System adding to convenience and enjoyment. Made by your telephone makers, it assures the faithful tone and dependable service for which Western Electric sound transmitting apparatus has been known for over half a century.

Western Electric

PUBLIC ADDRESS SYSTEMS

Distributed by Graybar *Electric Company*

SINCE 1882
MANUFACTURERS
FOR THE
BELL SYSTEM

Ramblings

By J. A. S.

Here's an electrical idea. Down in Tulsa, Oklahoma, it is said, a policeman has invented an electric cradle for the baby. It is so arranged, we are informed, that when baby cries or disturbs the air, the electric motor is set in operation, which rocks the cradle. When baby settles down and breathing becomes regular and the movements cease, the motor ceases which stops the cradle. Now, if there was some way that baby could be connected with the party line upon awakening, we'd almost wish we were a child again.

* * *

Representatives of the Automatic Electric Company attended the Oklahoma Utilities Association convention in their own airplane. Of course the telephone industry is right up in front, progressively speaking. And why shouldn't this great organization be one of the first to adopt this new method of attending conventions?

* * *

And speaking of Oklahoma and progressiveness, it was down in that state where he heard of a fellow who was experimenting with his bees and lightning bugs, hoping to cross the two and produce a bee with a tail light. In this way he figured he could produce bees working in twentyfour hour shifts.

* * *

And then, too, about combinations, the Oklahoma Utilities Association is composed of telephone division, gas division, electric light division, power and light division, etc. Several of the large electrical manufacturers have displays at these meetings. Hence some of the telephone sales representatives, who are only more or less unfamiliar with this line of equipment, have "dubbed" the Oklahoma meeting as the "washing machine convention."

* * *

A friend sends us a picture of an operator over in Ohio who has been operating for forty-four years. Naturally her age was not mentioned and we will have to admit that she looks twenty years younger than whatever her age is. But my, my! Don't you suppose she "nose" it all.

* * *

And more about Oklahoma. Our friend from St. Louis, P. Kerr Higgins, sends us a post card showing the picture of a plane which took him over to Tulsa for the Oklahoma convention. Mr. Higgins has made several trips by air the past year, hence he will be able to qualify as an expert from the "show me" state when "broader views" are discussed regarding Missouri and surrounding states.

* * *

R. G. Faulhaber, for years a representative of the American Electric Company, Chicago, has been appointed field sales manager of that organization. Coming down from the Dean Electric Company, the Garford Manufacturing Company, the Stromberg-Carlson company as salesman, later he was connected with the Automatic Electric Company where he remained until the acquisition of the American Electric Company by the present owners, when he was transferred to the latter company. Faulhaber is well known to the telephone industry and will be at home in any section of the country.

* * *

Coming through Jamestown last week we learned that Wright Metals, Inc., under the guidance of John H. Wright, was operating in a very satisfactory manner, which is very interesting to the many friends of Mr. Wright throughout the telephone industry. We also noted that the new automatic building being erected in that city by the Jamestown Telephone Corporation was progressing in a manner pleasing to the organization.

* * *

Ray Blain, a monthly contributor to TELEPHONE ENGINEER, is in receipt of a letter from an employe of the Southwestern Bell down in Texas, who it seems was the foreman over Ray when he first made his appearance in the uniform of a lineman "way back when—." Theo. Keen is the man, and he picks up the thread of happenings to Ray through the articles running in this publication. Soon we expect to hear of a happy reunion of old friends and these two boys as the principals.

* * *

A letter from our old friend, Tom Bearden, down at Baird, Texas, brings happy recollections of our former activities in that section. Bearden started out some time ago with an exchange and repair shop at Baird, Texas, and when the properties began to change hands, he bought properties instead of selling them. Now he has a string of exchanges as long as your arm. Bearden says he missed us at the convention. We missed you and the other boys too, Tee Pee, and here's hoping we'll be able to see you at the same time and place next year.

* * *

Yes, we would liked to have been down in Texas during the annual round-up of telephone men; this was the twenty-fifth year of the association, and the twenty-fifth anniversary of Transmitter, which furnished us bread and butter for a score of years. During that time we have noted many changes in the personnel of companies; many have retired to other lines of work, and many have gone to their reward. Since 1912 we have been at the table when noses were counted and checked and double-checked against the year before; so it was indeed a disappointment to us that we had to break the chain.

* * *

Rambler was caught in the snowdrifts between Chicago and New York during the last big snow.

New Equipment for Two Exchanges

The Stromberg-Carlson Telephone Mfg. Company has just announced the receipt of orders for switchboards and equipment for two exchanges.

The Rochester (N. Y.) Telephone Corporation has a contract with that Company for equipment to be installed at Warsaw, New York. A 12-unit type section will be installed and will be equipped with 600 Central Energy and 120 Rural and Toll Lines.

The Standard Telephone Company of Lubbock, Texas has placed an order for a 5-unit type section switchboard for the Dalhart Exchange. The board will be equipped with 700 Central Energy Lines and 40 Rural and Toll Lines.

These Switchboards will be complete with terminal, power and machine equipment.

A Visit to the North Electric Mfg. Co.

By Ray Blain

I had the pleasure last week of making a visit to the plant of the North Electric Mfg. Co., Galion, Ohio. I found this plant running full blast and believe that ninety per cent of the work under way was all relay type automatic telephone equipment. The testing room was full of this equipment, and while I didn't count them I believe there was at least 50 of these units going through the final test. I am keenly interested in the "All Relay" equipment as I feel sure that in a few short years it will be one of the leading type automatic systems in common use. Automatic engineers have known its advantages for years but its higher cost as compared to other types has held it down to a great extent particularly on the larger systems. The extended research and development of the North company has brought about many refinements which has gradually decreased its cost. This is noticeable by the fact that in many cases they are making one relay do the work of several and when one relay clicks where several clicked before the cost is bound to be less. I look forward to the time in the not far distant future when the cost will be down so that "All Relay" will be practicable for main exchanges and then troubles will be few.

April, 1930
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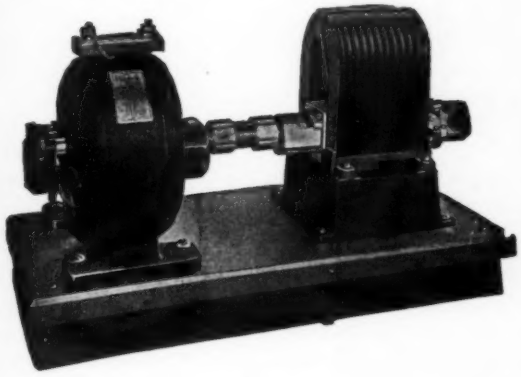

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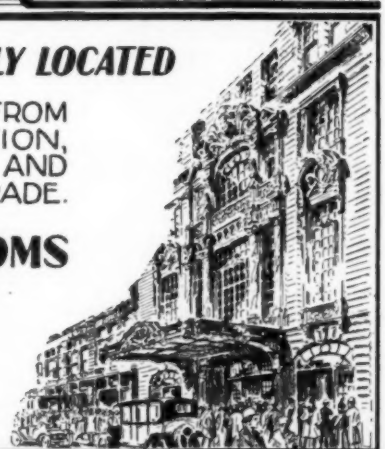

CHICAGO

Studying Telephone Methods

(*Continued from page 24.*)

of Relay "A" to ground at the armature of the low relay. This causes the armature of "A" to pull up. Now battery from the start solonoid finds a path to ground through the armature of Relay "A." This causes the plunger to drive the starting switch into the starting position. This also cuts off the current supply from the start solonoid to Relay "A." The faces of contacts 5, 6, 7, 8 of the starting switch are wide so that the starting switch has gained sufficient momentum to complete its stroke before the start solonoid is cut off.

Relay "A" is slow acting so that it will complete its stroke should the contact of the low voltage relay be light. The armature of Relay "A" also connects the winding of the low voltage relay to ground. It had been held up through the 1000 ohm resistance before. This insures that the low voltage relay will restore to its operated position.

The generator is now charging the battery. As soon as the voltage rises to 52 the high voltage relay pulls up. Then current from the stop solonoid now flows over contacts 6 and 5 through the 4 ohm winding of the "B" relay to ground at the high voltage relay and pulls the starting switch into the stop position. Relay "E" has a make before break set of springs. Relay "B" is therefore locked up through its own contacts, and the high voltage relay is released opening the circuit to "B." As soon as the start switch is in the stop position, the solonoid battery of the stop coil is cut away from Relay "B" and its armature releases. Here again the Relay "B" is slow acting so that the light contact of the voltage relay will have to saturate "B" sufficiently before it pulls in and also makes "B" slow to release. The high and low voltage relays can be given a standard adjustment which will make a dependable voltage regulator.

Gasoline Charging Set.

Where electric power is not available to charge the batteries, the voltage control set can be used to ring a voltage bell. Then the attendant must attend to the charging of the battery. The solonoid switch for connecting the battery to the generator will be used, but the start and stop switch will not be needed. The generator set shown in Fig. 299 is operated by gasoline. The engine is started by stepping on a lever. Sufficient gasoline to complete the charge is placed in the tank. As soon as the voltage of the generator is high enough the solonoid switch connects the battery to the generator and cuts in the counter cells. As soon as the gasoline is all gone, which should complete the charge, the generator cuts away from the battery in the manner already described.

Texas Association Holds Meeting

Celebrating their Silver Anniversary, the Texas Independent Telephone Association held its annual convention at the Texas Hotel, Fort Worth, Texas, on March 18th and 20th.

The meeting of the Texas association is one of the largest of the state associations and the meeting last month was one of the banner conventions. Speakers of national renown were on a well diversified program for the entertainment and edification of the members who assembled from all sections of Texas. The meeting was branded a great success by the officers through their perennial president, R. B. Still, General Manager, Gulf States Telephone Company, Tyler. Mr. Still is known throughout the land as one of the most aggressive presidents the Texas Association has ever had and was again honored by the membership by being re-elected their president. This same honor was shown L. S. Gardner of Waco, Texas, in being re-elected secretary as he has served in this capacity for many years.

Interspersed among the papers delivered were "talkies" shown through the courtesy of the Bell company. The International Lumber & Creosoting Company also had several reels of instructive pictures that were much appreciated by those attending. The program was well presented each day and the association is to be congratulated on the manner in which sessions were handled.

E. R. Stonaker, of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., read a very interesting paper and was roundly applauded by those in session. The annual president's report was also well received and Mr. Still was the recipient of many words of commendation by the membership. The other officers in their reports gave the assemblage much valuable information as to the activities of their association during the past year, and last but not least, that the financial condition was in good shape.

It is impossible to list all of the speakers, which included C. C. Derring and Miss Anna Barnes of the United States Independent Telephone Association, however, it is in place to say that the program this year was, in the writer's opinion, one of the most instructive we have ever heard. The exhibits of the various manufacturers were a novelty to those who are not able to have this valuable service demonstrated to them in their home towns. Representatives stated that much interest was shown by local owners in new equipments; that is seen as a barometer showing improvements are being made all over the state.

The following officers were elected at the first meeting of the board of directors: R. B. Still, Tyler, president; L. S. Gardner, Waco, secretary; D. J. Johnson, Santa Anna, treasurer; John W. Pace, Haskell; John Y. Rust, San Angelo, and C. A. Shock, Sherman, vice-presidents.

Stromberg-Carlson Net Earnings Break Record

(*Continued from page 34.*)

ucts been dumped on the market. Prices have always been maintained, and the policy of the company, Mr. Scoville said, has been dedicated to quality products at fair prices and its production flows into the most substantial channels, he asserted. He pointed out that sales in New York and other large congested areas have been increasing substantially.

Mr. Angle said that the company has always tried to prevent speculation in its stock, and in every way has kept its affairs moving along the soundest and most conservative lines. The company is controlled by its employees and their families.

Mr. Angle pointed out that since Dec. 31, last, the notes payable of the company have been reduced from $1,100,000 to $600,000.

To assure adequate facilities for growth of the company, it has continued its lease on the old factory which covers 190,000 square feet of floor space and some departments continue to operate there. However, virtually all of the major moving operations have been completed and while the move occasioned, naturally, considerable expense and increased the difficulty of supervision while it was going on, it was accomplished with little disturbance to production.

With nothing but active merchandise in possession of the company; with its dealers urging the maintenance of the high quality production in a quality selective field, and with the surplus stocks of radio receivers in the market being consumed, the prospects for 1930 are most gratifying, both Mr. Scoville and Mr. Angle asserted.

Directors of the company are: Wesley M. Angle, Fred C. Goodwin, Edward A. Hanover, W. Roy McCanne, Ray H. Manson, George A. Scoville, George W. Todd, and J. Foster Warner.

Officers are: Chairman of the board, George W. Todd; president, W. Roy McCanne; vice-presidents, George A. Scoville, Edward A. Hanover, and Ray H. Manson; vice-president and secretary, Wesley M. Angle; treasurer and assistant secretary, Edwin C. Roworth; assistant treasurer and auditor Wilbur W. Hetzel; comptroller, George V. Lennon.

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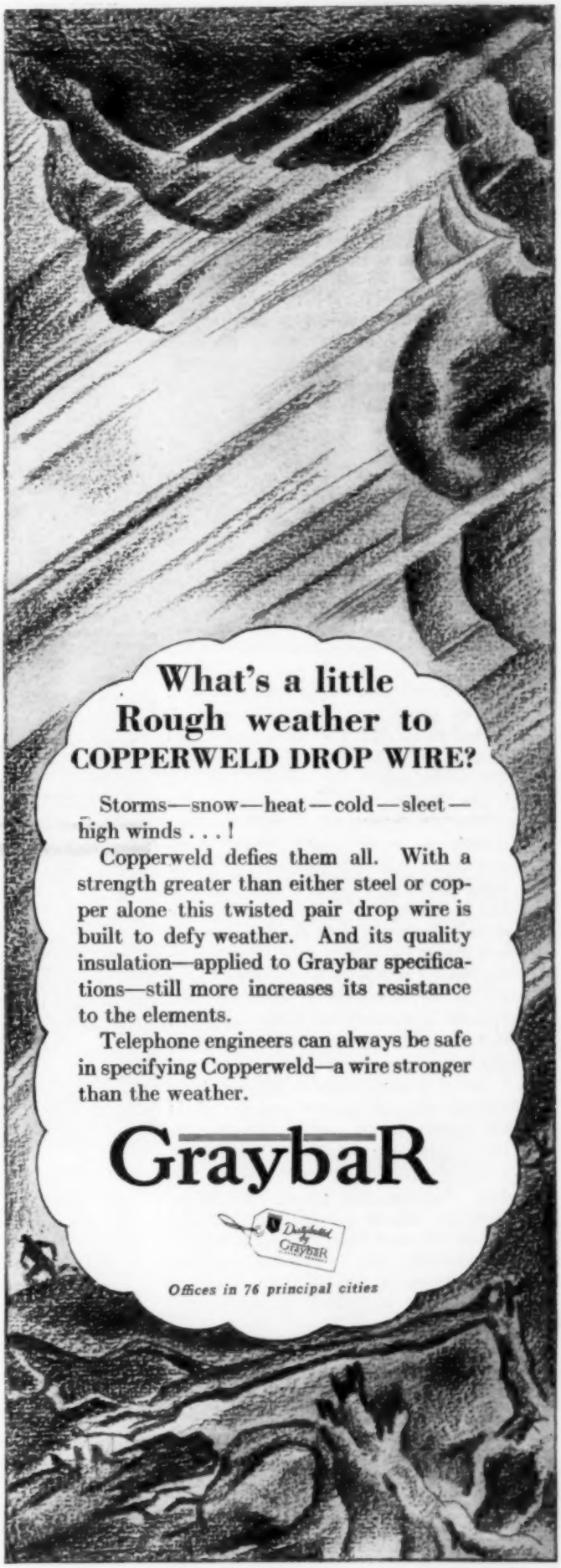

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LINE AND DESK

SOME SATISFACTORY EXPERIENCES WITH COMPOUND PROTECTED UNDERGROUND CABLE

I read with interest the article in your February issue written by Mr. Ray Blain in reference to underground cable construction. I am sure there are several efficient methods of construction. But for the smaller telephone companies I believe that the trench, and everprotect method is the most economical. In planning the layout several things should be taken into consideration. Plan for future growth, and study the soil along the route of cable. Where soil is of a heavy clay you do not need as heavy a coat of everprotect as where the soil is loose. Soil containing acid also requires a heavy coat of everprotect on the cable.

I installed underground cable about twenty years ago laid in compound. Three years ago this same cable was topped for a 10 pair service terminal. The cable beneath the compound was as bright as the day it was placed in the trench. No trouble of any kind has been experienced in this cable. Since the recent sleet I installed 3,500 feet of 50 pair cable at Sweetser, Ind. This cable is laid in a trench 34 inches deep, and the cable is treated with a heavy coating of everprotect cable compound. For growing cities I would advise the use of conduit as the cables can be withdrawn and replaced with cables of larger capacity. But where the future growth of a plant can be estimated for the life of the cable I am thoroughly convinced that cable treated with everprotect and buried in the trench without conduit will give entire satisfaction, and can be installed at a considerable saving compared to conduit. Another cable buried about fifteen years ago without any treatment or protection of any kind developed trouble last summer. This occurred where ashes were thrown in the alley, which caused corrosion of the armor. Cable buried should be brought up the poles to terminals through riser pipes. These should extend below the surface beyond the frost line, as freezing might crush the cable, and this also affords protection to cable against injury due to climbers, or curious boys. If other readers have had experience with underground cable pass your experience along, as this may help others who are considering cable installations.—Contributed by Delbert Myers.

A DROP-WIRE TAKE-UP REEL

A take-up reel for use in dismantling twisted pair or parallel insulated wire developed by H. C. Harrison, construction foreman employed by the Southern Bell Telephone and Telegraph Co. at Louisville, Ky., is described in a recent number of Southern Telephone News. The device is designed to be attached to the winch shaft of a truck.

The "nigger head" is removed from the winch and a specially built frame is slipped over the shaft. This frame is shaped like a Yo-Yo with one side demountable so as to remove the wire after it has been rolled up.

The end of the wire is attached, the

The reel used at Louisville, ready for operation. Note the connection at pole.

motor is started and ten to twelve spans of from six to ten wires can be rolled up in a neat, small coil in ten minutes.

In the city this reel is especially valuable, since the wire being removed can be pulled over feeder wires, electric light service wires, trolley feeders and power circuits with a minimum amount of danger. It is not necessary to block the street while the dismantling work is going on. Also, the hazard of having a man run down by passing motorists while engaged in taking down and coiling up the wire is eliminated.

To make it more safe, the only man near the wire is standing on a safety platform watching the reel. This is an old splicer's platform with glass insulators on the bottom.

In making use of the "Yo-Yo," a trailer is parked at the other end of the pull with two reels of rope mounted on the body. One of the ropes is attached to the ends of the wires, and by means of a brake the wires are kept tight at all times to prevent sagging and coming in contact with other wires.

All of the wires on one side of each pole are removed in one pull and the wires on the other side are attached to the other rope and, as it is pulled out, the first reel is automatically winding up the rope used in the first pull. These two reels are on one axle but the rope on the one is wound opposite to the other.

This equipment can be removed from Foreman Harrison's truck and transferred to any other one having a standard winch shaft.

RADIO SYSTEM CAUSES REARRANGEMENT OF POLICE TELEPHONES

Rearrangement of the police telephone system to provide for reception of all calls at one central control room is planned in connection with the installation of a police radio system according to a copyrighted story in the Chicago Daily News. Although the Chicago department is not the first to be radio equipped the installation when completed will be the most extensive in the country.

The first step in the installation of the Chicago equipment was a complete rearrangement of the telephone system. Instead of making connection with any one particular police station all incoming calls now will come to the central control room located on the top of the fifteen-story police headquarters building. Alongside the operators who receive the calls from citizens are to be the clerks who will handle the reports and convey the message to the dispatchers.

Not more than two seconds after the receipt of a message the dispatcher will have the transmitter in operation and the patrol cars cruising over the city will be apprised of the crime in progress within a few seconds more. Receivers will be installed in each of 140 patrol cars and in the district stations, and at the same time it is planned that, as soon as possible, the number of patrol cars equipped with receiving sets will be

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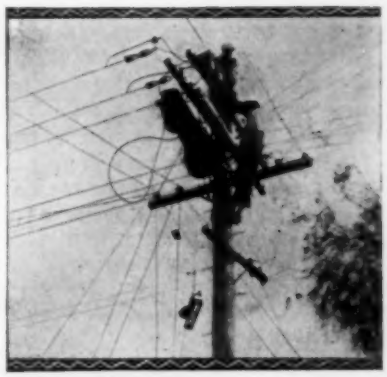

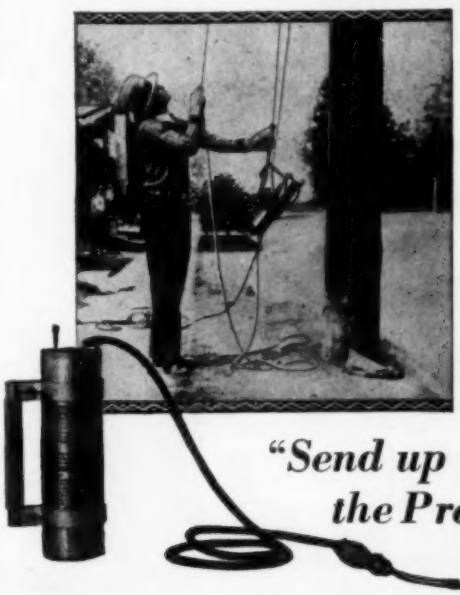

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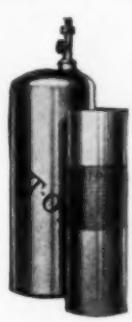

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increased by at least 100. The receiver is an adaptation of the AR-1286 RCA aircraft receiver designed primarily for reception of radio range beacon signals. The cars that are delivered to the police department have been equipped with an antenna system built in at the factory.

Method of Control

The transmitters are of the Western Electric type, developed by the Bell laboratories and the Western Electric Company. A single transmitter is not depended on for the work, however, and one is being installed at each of three stations located in the north, west and south sides of the city. Each transmitter is capable of delivering 1000 watts of power, although the license calls for 500 watts.

Each station can be operated individually or collectively with the other two. The two men who control the transmitters are known as dispatchers and besides the control of the radio transmitters they have connection with each of several important offices connected with the tracing of criminals.

The operator on duty at the telephone positions in the control room will receive calls coming from citizens notifying him of crimes in progress or already perpetrated. He pushes his key to another position and simultaneously talks to the dispatcher, the dispatcher's clerk and the record clerk, each of whom takes the record. The message is then given over the air to be picked up on the receiving sets in the squad cars. Less than two seconds is required to place the set in full operation following the receipt of the message by the dispatcher.

EXPANSION JOINTS IN BRIDGE CABLE

One of the most unique telephone installation jobs was completed on Armistice day. The installation job had to do with the furnishing of telephone service at three points on the bridge, and in the general offices of the Detroit International Bridge company.

In peculiarity of construction, the installation is unusual. On July 4, engineers say, the bridge actually will be 34 inches longer than on Christmas day—providing the weather is normally warm on the nation's birthday, and normally cold on Christmas. Summer heat will cause the structure to expand, and in planning and installing telephone wires and cable on the bridge, that expansion had to be considered. Otherwise, it is quite possible the equipment would be torn out by the roots, so to speak.

From the American approach to the Canadian approach of the bridge is approximately 7,180 feet, while the span between the two towers is 1,850 feet, the longest single bridge span in the world. At intervals along the great causeway expansion joints have been provided, 17 in all, to care for the expansion and contraction of the span as well as the vertical movement of the bridge under load. The two largest expansion joints are located at the towers. The cable splicing boxes are located at the expansion joints.

The Plant Engineering department was confronted with an unusual engineering problem in connection with the design and location of the splicing boxes. The splicing boxes were placed on the fixed sides of the expansion points. In the semi-rigid type of bridge construction, it is possible to use pump-log, fiber or clay duct, and manholes made of brick or concrete. But, on the Ambassador bridge it is necessary to use rigid steel conduit and metal splicing boxes, and to hang the equipment from the structure of the bridge and underneath the sidewalk.

Making the flexible joints

Located in the terminal building on the American side, is an attended private branch exchange switchboard, which is connected with Lafayette central office by means of three trunk lines. This private branch exchange serves ten telephones in the bridge company's offices and three on the bridge itself, which are housed in boxes similar to those used for taxicab telephones. Two of the latter instruments are located at the towers, and the third in the middle of the bridge. There also are public pay stations at each end of the bridge.

In the conduit was installed a 16-pair, 19-gauge cable extending from the Administration building on the American shore to the Canadian anchorage. Two pairs of lead covered cable were spliced into the main cable and terminated in each of the telephones on the bridge. At the point where the conduit enters the splicing box, a companion flange was employed to provide a bearing to permit the free movement of the conduit with the expansion and contraction of the bridge.

At the expansion points at the towers, a special expansion joint of the telescope type was designed, which provides for the lateral expansion of the conduit and also cares for the vertical movement of the main span, which produces a rocker effect under load at a point approximately five feet from the center of each tower.

To protect the armor of the telephone cable from cracking or buckling when expansion and contraction takes place, it was placed in a flexible brass conduit at each entrance point to the splicing boxes. The splice was securely mounted on an oak board in the splicing box, to permit the splice to move freely without injury to the wiped joint.—The Michigan Bell.

Takes Over Manufacturing Plant

The International Standard Electric Corporation, manufacturing subsidiary of the International Telephone and Telegraph Corporation has purchased control of the Oesterreichischen Telephonfabrik Aktiengesellschaft vormals J. Berliner, located in Vienna, and of H. Telephonfabrik Berliner Aktiengesellschaft in Berlin, according to advices.

The former company is engaged in the manufacture of telephonic apparatus and equipment primarily for the Austrian government, which operates the telephones and telegraphs in Austria.

Decatur, Texas, Telephone Property Being Rebuilt

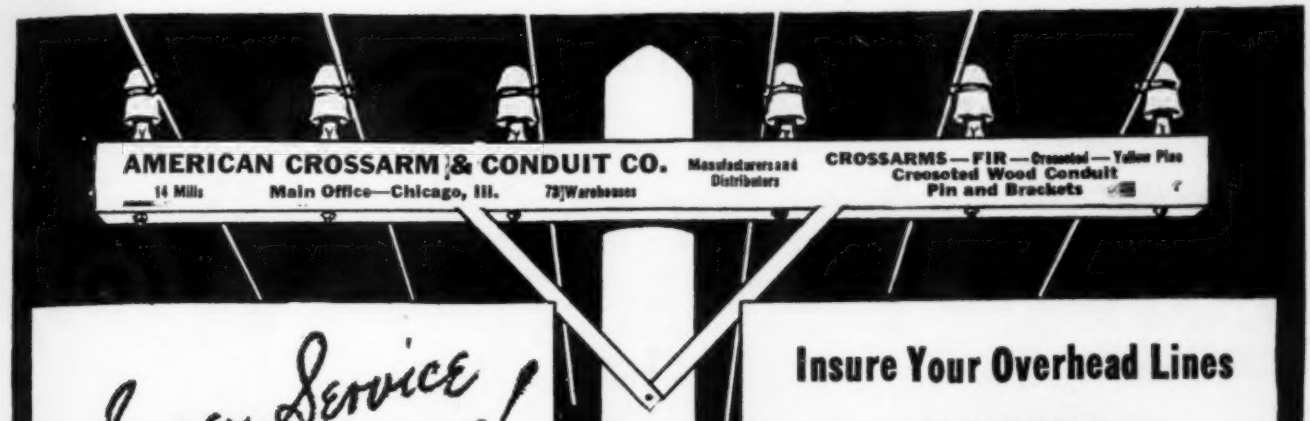
Decatur Telephone Company, Decatur, Texas are rebuilding their exchange, putting this property in first-class condition, and are now cutting over to their new building. They have one of the most up-to-date office buildings in the state, something any telephone company can be proud of. T. P. Bearden, General Manager and W. N. Cox, local manager invite their telephone friends to visit them and look their property over. The citizenship of that community compliment the fine improvements that have been made. No reason why their service will not be good, switchboard and office equipment has been made first-class.

A Giggle from the Testboard

(This was an actual order which came through).

Disconnect order No. .....

Disconnect telephone. Party died; left no billing address.



Super-Service on rush orders!

If you are in a hurry your order can be loaded and on the way the same day we receive it. Quality poles since 1882 assures you of guaranteed stock and satisfactory dealings. Let us quote you prices.

Northern and Western Cedar
With or without butt treatment

NAUGLE POLE & TIE COMPANY
59 East Madison Street, Chicago

Branches: New York, Columbus, Kansas City, Spokane, Los Angeles, Boston, Madison.

Main Yards and Butt-treatment Plants: Minneapolis, Pinconning, Michigan, Spokane, Sand Point, Idaho, Seattle, Arrowhead, B. C.

Naugle Poles

Insure Your Overhead Lines

BY SPECIFYING

MacGillis

NORTHERN or WESTERN

CEDAR POLES

PLAIN or BUTT-TREATED

FROM

MacGillis & Gibbs Co.

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MILWAUKEE - WISCONSIN

Bell Cedar Poles

Piling & Ties

Western Red - Northern White

Creosote Butt Treating—Any Specification

Guaranteed N. E. L. A., W. R. C. A., N. W. C. A. Grades

Treating Plants and Concentrating Yards

Minnesota Transfer, Minn., Newport, Wash.

Other Concentrating Yards at British Columbia Points

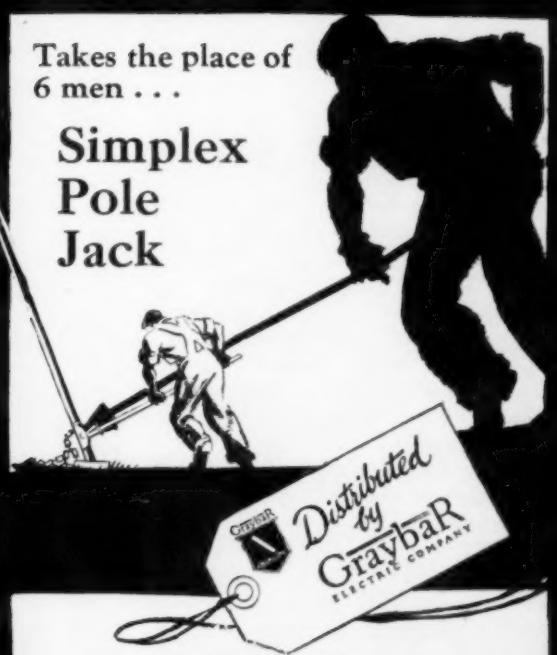
There Are No Better Poles Than Those Produced by

BELL LUMBER & POLE CO.

Security Building Minneapolis, Minn.
Long Distance Phone Atlantic 2304

Takes the place of 6 men . . .

Simplex Pole Jack



Templeton, Kenly & Co., Ltd.
Sole Manufacturers
Established 1899 Chicago, Ill., U. S. A.

Foreign Distributors:
International Standard Electric Corporation
Northern Electric Company, Ltd.

Cedar Poles

Northern White Western Red
Plain or Treated Butts

Prompt Shipment from Minneapolis Yard.

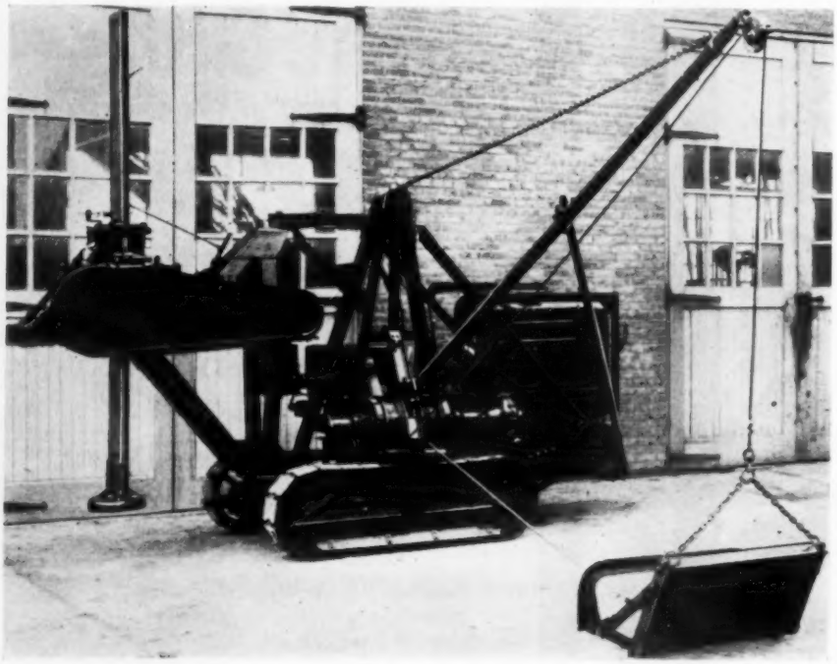
T. M. Partridge Lumber Co.
Minneapolis, Minn.

With the Manufacturers

New Machine by Cleveland Trencher

The Cleveland Trencher Company of Cleveland, Ohio, who for many years have been manufacturing trench digging equipment, have just announced a new machine which combines the related operations of tamping and backfilling. This machine is of special interest because by its use the necessity of tamping and backfilling with hand-labor is eliminated.

The Cleveland tamper-backfiller is a compact, powerful machine built in accordance with the policies adopted by this company for many years, in the construction of their trenchers—Cleveland baby digger and Cleveland pioneer.



Cleveland Trencher Company's Tamper-Backfiller speeds work

The Cleveland tamper-backfiller is but 58 inches in extreme width, thus permitting it to be used in the narrow and confined areas. It is mounted on full crawler tracks for ease of handling and to enable it to travel over rough ground, across excavations, etc.

The tamping mechanism, which will work either at the center or side of the machine, consists of 180-pound steel tamping head which can be dropped 45 times per minute from a height of 26 inches. Gear shift speed changes provide instant means of determining the number of blows struck per given distance according to the requirements of the soil.

It is interesting to note that with this mechanical tamping such materials such as wet clay, which is exceedingly difficult to tamp by hand, are very easily handled with the Cleveland tamper. This also eliminates any necessity of hauling away the wet clay, and the expense of backfilling with some other material like sand or gravel. Moreover, the Cleveland tamper will replace the earth so tightly that less remains to be hauled away.

The usual method of tamping with the machine is to straddle the trench and tamp in the center, but where obstacles do not permit this type of work, the mechanism of the Cleveland tamper may be easily and quickly swung so that the machine may run parallel with the trench and tamp at full efficiency at the side.

Backfilling and tamping speeds of 3½, 7 and 11½ feet per minute are available and the unit has a road speed of five miles per hour.

The backfiller, of a conventional type, operates with a telescopic boom with a length which can be varied from 14 feet 2 inches (telescoped) to 20 feet 2 inches (fully extended). The entire unit is self-contained and is powered by a four-cylinder Hercules model OX gasoline motor.

W. N. Matthews Corporation Exhibits One-Man Pullift

The W. N. Matthews Corporation, St. Louis, Mo., manufacturers of electrical specialties and tools, have patented and placed on the market a new one-man hoist and puller to be known as the Matthews Pullift, with a capacity of 5000-lb. maximum.

The Matthews Pullift will be found to be exceptionally safe, useful and economical in performing practically any pulling or hoisting operation. While designed primarily for pulling the slack from conductor and guy wires, it can be used for hoisting transformers, etcetera. Its usefulness is not limited to the public utility companies; any industrial concern such as machine shops, automobile repair shops or railroad shops, road construction or rigging gangs will find this tool of great advantage.

The Matthews One-Man Pullift

A magazine provides a safe means of keeping the free end of the chain from coming into accidental contact with live conductors; however, the magazine is optional.

A hook or a clevice is supplied on each end; or with a hook on one end and a clevice on the other; the hooks and clevices are interchangeable, so that rearrangement, if desired, can be made after the tool is received.

The Matthews Pullift has a take-up of five feet when the magazine is not used; when the magazine is used, the maximum take-up is reduced to 4 ft. 7½ ins.

Matthews Pullifts Nos. 750, 751 and 752 can be supplied with any length of chain desired; thereby increasing the amount of take-up.

In order to combine adequate strength and light weight, high-strength steels and certified malleable iron have been used; wearing parts have been heat-treated in order to insure long service.

Matthews Pullift has the following ad-

vantages:

(1) Due to the worm and worm gear, the load is always carried on the tool, and is not transmitted back to the operator through the ratchet handle.

Showing possibilities of Matthews Pullift

(2) The use of pawls and springs has been avoided.

(3) Ratchet handle permits easy operation under heavy load or in restricted places.

(4) Any length of chain can be used, thereby multiplying the uses of the tool and greatly simplifying the work.

(5) Matthews Pullift is exceptionally fast; 1,000 pounds can be lifted 16 inches per minute; heavier loads proportionately.

(6) Exceptionally safe because the load is always carried on the tool and never on the operator.

(7) Weighs only 33 pounds and therefore can be readily transported.

(8) Magazine provides a safe means of taking care of the free end of the chain.

He's Proud He Made First Stromberg Switchboard

Andrew Henrickson, one of the oldest employes in point of service of the Stromberg-Carlson Telephone Manufacturing Company, whose family tree goes back to Viking ancestors that roamed the seven seas when Odin was "god" and Thor his "thunderer," celebrated his seventy-third birthday March 1.

The occasion, in addition, marked his thirty-eight years of continuous service in the business of making telephone switchboards.

Henrickson holds many records, but one he treasures most is his participation in the construction and installation of the first telephone switchboard built by Stromberg-Carlson. That happened no less than thirty-five years ago. Henrickson was sent with it to Minneapolis and St. Paul.

Andrew Henrickson, who made the first Stromberg-Carlson telephone switchboard

Henrickson, who retains the quaint accent of the Swede in his speech, regaled his listeners with tales about the partners, Alfred Stromberg and Andrew Carlson. "Make it better than possible," was Stromberg's motto, Henrickson said, and he used to tell his employes that no matter how well a thing had been done, "it was never too good for the public."

Henrickson, who is bronzed of features and rugged in physique in spite of his seventy-odd years, told how he came to America from a little Swedish town

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Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies.
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Special attention given to all matters pertaining to Valuations and Investigation of Public Utility Properties.
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Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
Certified Public Accountants
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Common Battery Oak Residence Type Wall Sets

Kellogg F-729-SA straight line ringers $5.75

Kellogg F-729-HA or HB harmonic or syncromonic ringers $6.25

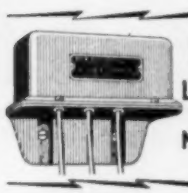
Leich Elec. Co. 29-A induction coil type, straight line $4.50

Leich Elec. Co. 29-C harmonic or syncromonic $5.00

Buckeye Telephone & Supply Co.
COLUMBUS, OHIO

Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
711 Poplar St., Terre Haute, Ind.

FOR SALE
Bakelite mouth-pieces for Western Electric transmitters, $6.00 per 100, 1-groove porcelain knobs, $7.50 per 1,000, 2-groove porcelain knobs, $10.00 per 1,000, 4-groove porcelain knobs, $20.00 per 1,000. New black receiver cords, 26-inch, 15c. Western Electric No. 14 terminals, 15 pair with stubs, $4.50. Holtzer-Cabot motor generator ringing machine, 110-volt, nearly new @ $60.00
The Telephone Repair Shop
6966 Ravenswood Avenue
Chicago, Ill.



CHAPMAN
LIGHTNING ARRESTERS
MADE BY
MINNESOTA ELECTRIC CO.
MINNEAPOLIS, MINN.

We will sell your
Telephone Directory
ADVERTISING
or will publish your directory complete
L. M. BERRY & CO. DAYTON, OHIO

called Semrithshavn.

"That happened in February 1878," he said reminiscently. "It took the vessel on which I was one of 200 passengers, twenty-one days to cross the Atlantic.

"On the banks of New Foundland we ran into a storm which caused the ship to roll so badly that all, including the captain and the 'sea dogs in the fo'cas'le' were pale from sea sickness.

"Personally, I didn't care whether the ship kept afloat or went to the bottom—I was that sick. However, we did reach New York, and I arrived in Chicago March 4, 1878.

"Crime waves, bootleggers, gangsters, racketeers and beer barons were unknown, and one could walk along Michigan avenue without the fear of being drilled by machine gun bullets."

A cabinet maker by trade, Henrickson went into that business as soon as he had saved enough money to rig out a place for himself. By 1892 he had established a shop that attracted Stromberg, who was then operating his plant in Chicago, with the result that the latter bought Henrickson's shop and engaged him as a switchboard maker.

October 4, 1904, he came to Rochester, after the factory moved there, and has been here ever since.

Bell Buys Teletypes

Oklahoma City.—The Southwestern Bell Telephone Company had 553 telephone typewriter machines in operation at the end of 1929, a gain of 221 during that year. One of these typewriters was on display on the mezzanine floor of the New Hotel Tulsa at the 12th annual convention of the Oklahoma Utilities Association at Tulsa, being connected up with the general offices of the company at Oklahoma City.

Straightforward Trunking Studies

(*Continued from page* 21.)

up which are new to Straightforward Trunk equipment:

1. The locking up of the sequence of the lamp indication at the "A" Board.
2. Provision of a Master Busy Back Key to replace Busy Back Jacks, at the "B" Board.
3. Combining Lamp Indication, Automatic Listening with Master Ringing Control Keys.
4. Provision for emergency operation on a Key Listening basis, this key listening equipment being of a more efficient type than any other key listening equipment.
5. Provision for overlap possibilities in the operation of Ringing Keys, Busy Back Key and the Automatic Listening Circuit in the case of the Automatic Listening equipment and in the operation of Ringing Keys, Busy Back Key and Listening Keys in the case of the emergency Key Listening equipment.

Orders Stromberg-Carlson Junior Multiples

The Midwest Telephone Company has just placed an order with the Stromberg-Carlson Telephone Mfg. Company of Rochester, New York, for a two-position Junior Multiple Switchboard and equipment for Oak Grove, Missouri. The new equipment will consist of 240 subscribers lines and 40 toll and rural lines.

Salesmen Will Be Retained by Kellogg

The report printed in newspapers of the country recently that the Kellogg Switchboard & Supply Company will dispense with a number of its representatives was promptly denied by G. A. Yanochowski, president of that organization. This concern has representatives throughout the country and a number of branch houses.

Reconstructed Equipment

Western Electric Co. No. 317 A. H. type 3-bar 1000-1600 or 2500 ohm Bdg. compact type wall telephones @	$ 9.25
Am. Elec. or Andrae 5-bar Bdg. hand Generators complete @	2.35
Am. Elec. or Andrae 4-bar Bdg. hand Gen. complete @	1.65
Automatic Permanent Magnet receivers complete with cord and New Western Elec. Shells @	1.10
Stromberg Carlson No. 599 type 4-bar 1000 or 1600 Bdg. compacts	6.90
Kellogg No. 2696 type 4-bar 1000 or 1600 ohm Bdg. compacts @	8.50
Monarch 4-bar 1000 or 1600 ohm Bdg. compacts @	7.25
Kellogg magneto desk sets with New cabinet inside connection signal set 3-bar 1000 or 1600 ohm $10.00—4-bar $10.75—5-bar @	11.50
Chicago Tel. 4-bar 1000 or 1600 ohm Bdg. compacts with Kellogg transmitters $7.25—5-bar @	8.00
Stromberg-Carlson No. 599 type 5-bar 1600 ohm Bdg. compacts @	9.50
Kellogg No. 79 or W. Elec. No. 46 Common battery Ind. Coils @	.50
Kellogg No. 97 C. B. desk sets complete with No. 404 or 259 Straight line steel signal sets @	7.00
Kellogg Transmitters complete @ $1.10 —Western Elec. @	1.25
Western Elec. No. 143 Receivers complete with cords @	1.25
Reliable Elec. No. 27 One Amp. Wood Fuses, same as Cook No. A7. Distance between shoulders 4¾ inches. Per 100	3.50

Write for Our Bulletin

REBUILT ELECTRIC EQUIPMENT CO. Not Inc.
1940 W. 21st St., Chicago

UNIQUE
HEAT PROOF

Reduces Overhang to a Minimum

You pour the metal exactly where you want it. Drop by drop or in a stream!

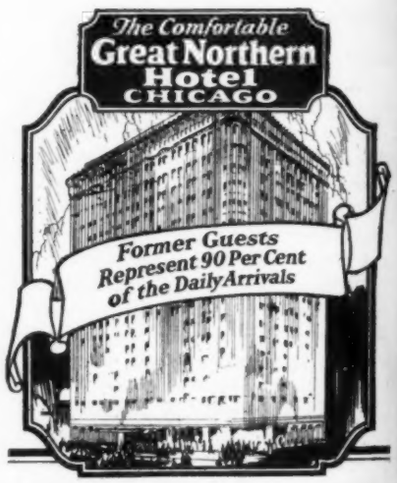
The ladle cannot slip, twist or pull out of the *ventilated* handle.

Interchangeable—no holes to drill—a screw driver is the only tool required to attach or remove.

Bowl Diameters 2½, 3, 3½, 4"

GET ONE ON TRIAL

UNIQUE MFG. CO., INC.
221 Whiting St., Chicago, Ill.



TRAVELERS select the Great Northern for its wonderful location in Chicago's "loop". They return because the large comfortable rooms, homelike environment, attentive service, excellent food and moderate charges make it an ideal hotel.

400 Newly Furnished Rooms
$2.50 a day and up

Sample Rooms
$4.00, $5.00, $6.00
$7.00 and $8.00

Dearborn St. from Jackson to Quincy
New Garage One-Half Block